Cover Sheet for New Degree Program Proposal

Institution:	**Eastern Washington University**
Degree-Granting Unit:	**College of Science, Mathematics, and Technology**
Degree:	**Bachelor**
Of:	**Science**
In:	**Electrical Engineering**
CIP Code:	**14.1001**
Mode of Delivery:	**Double Campus. Traditional Classroom and Distance Education**
Proposed Starting Dates:	**Fall, 2004 the Junior Year at North Seattle Community College and Fall, 2006 the Junior Year at Eastern Washington University**

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Endorsement by
Chief Academic Officer: ____________________

Date: ____________________

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I. Program Need

1.1 Relationship to Institutional Role and Mission

Eastern Washington University will achieve its mission by, among other things, "providing high-quality integrated, interdependent programs that build upon the region's assets and offer a broad range of choices as appropriate to the needs of the university's students and the region." The September 2000 report "A Strategic Plan for the Sustainable Economic Development of the Spokane Area of Washington", written by Dr. David Kolzow, calls for the local higher education institutions to strengthen or create programs in information technology, engineering, health sciences, software development, and professional services, all of which have been identified as important to the future growth of the Spokane area. Eastern Washington University can help achieve this economic development through the creation of an Electrical Engineering program in Cheney.

EWU's principal service area is the Inland Northwest, a vast region encompassing Eastern Washington, Northern Idaho, Western Montana, Eastern Oregon, and Southern British Columbia. This area offers a highly educated workforce, a low cost of living and doing business, exceptional technology and communications infrastructure and extensive resources in higher education, research, and health care. What the region lacks is a critical mass of professionals trained to fill the current needs of high-tech business and industry—a shortage that is felt nationally.

Eastern Washington University's mission further states, "Its campus is located in Cheney, within the Spokane metropolitan area, with additional learning centers in the region and elsewhere in Washington State." A tremendous shortage of engineers exists in Washington State while electrical engineer graduation rates are not increasing. In light of this, additional Electrical Engineering student capacity is needed in the State. As the largest potential for Electrical Engineering students exist in the Puget Sound region it seems appropriate to conduct an Electrical Engineering program in the Seattle area as well as Cheney.

1.2 Documentation of Need for Program

1.2.1 Justification

Why does a regional/comprehensive university need to offer an Electrical Engineering degree?

The Washington Council of the American Electronics Association (AEA) formed a Higher Education Task Force in May 1999 to undertake a workforce study. It revealed that within three years Washington State would need an additional "40,000 positions requiring technology degrees, training or certification" and concluded that "…the cure is to train more people…[where] the need is especially acute in engineering, computer science, informational systems and related technology fields." Further, the AEA task force advised that "state colleges and universities must increase capacity and improve access for would-be students" and that "Governor Locke and the legislature should focus on funding new capacity in higher education." The Washington State Higher Education Coordinating Board, in its Master Plan 2000, acted on this advice and stated its number one investment strategy to be "adding capacity in instruction, instructional support, and research space needed to implement the master plan initiatives for enrollment growth in high-demand fields."

A 2002 AEA evaluation of the need for engineers in Washington State concluded that approximately 10,000 new engineering positions were created each year before current Washington State difficulties. Now, approximately 5,000 new engineering positions are being created each year with between 2,000 and 2,400 engineering graduates coming from the institutes of higher education in Washington State. This leaves 2,500+ engineering positions unfilled each year. The AEA further stated that eight of the ten fastest growing jobs in America over the next ten years require high tech degrees. Degrees must triple to keep up with job opportunities. But, on-the-other-hand the Washington State's institutions of higher education graduate fewer high-tech degrees now than ten years ago.

A 2000-2001 U. S. Bureau of Labor Statistics Report indicated that the Washington State high-tech industry employed 135,763 people at 5,444 companies with a payroll of $15.9 billion. This translates to high-tech firms employing 61 of every 1,000 private sector workers in Washington State. Of these 135,763 jobs, 60,000 were created in the past decade. This number could have been much higher had not the shortage of engineers and scientists been so acute. This engineering shortage problem also affected other sectors of the economy as well.

The most recent statistics from Washington State Employment Security Department (June 2002) show that need for Electrical Engineering employment will grow annually by 2.2% in Spokane County, 1.4 % in eastern Washington, and 2.0 % in Washington State between 2005 and 2010. All occupations are expected to rise only about 0.8 % for each of the three locations. The total number of electrical and electronic engineers expected to be employed in the state by 2010 is 7905.

A May 2003 study by the Seattle-based Technology Alliance states that we should be keeping up with our peer states in terms of technology but we are not. The State of Washington ranks down the list among its peers in three key areas—education, research capacity and entrepreneurial environment. The Report states, “The number of bachelor’s degrees granted overall, and particularly in science and engineering majors, is in the lowest third of the nation on a per capital basis.” It further states that technology thrives in states where education systems stress science and engineering, producing technologically sophisticated workers.

The State of Washington has recently experienced a significant downturn in its economy caused by a worsening recession and a significant downsizing in 2001 of a number of companies, particularly those in the aerospace and high technology industries. In higher education, the fallout from this stressed economy will be more individuals seeking to go to college. These anticipated increased enrollments coupled with the following workforce demographics provide a compelling argument for additional student capacity in engineering.

- Despite the current economic recession within the State of Washington, most reports agree that when the economy recovers the number and size of technology companies will grow, major projects currently on hold will move forward, and there will be rapid turnaround in the number of employment opportunities. According to a March 2003 report by American Electronics Association, while 10% of the technology workforce has lost jobs nationwide since 2001, those in software services and electro-medical equipment have experience slight gains in the job market (Seattle PI; 3/19/2003).

- The need for Electrical Engineering within the region and state will exceed~~ed~~ the current structures’ ability to keep up with the demand for qualified personnel. The rapid growth of the computer industry, compounded by a very small number of educated personnel, is creating a demand that, in some areas of industry, will result in a workforce crisis with the rest of the industry following closely behind. As computer networking, electrical, and electronic applications continue to grow, the demand for Electrical Engineering graduates will continue to grow at an even faster pace. As the American worker faces the effects of the economic slowdown, the potential candidates for the Electrical Engineering program are increasing as more and more information is released about the ever-growing world of electronics and e-commerce and the positive effect it has on our economy.

- A Washington Technology Center report from February 2003, noted a mixed economic situation with telecommunications still down, but some high technology areas showing renewed growth. The growth in technology employment for the combined Tri-Cities and Spokane metropolitan areas showed a modest but positive grow of 1.3% in a recent statewide report (Index of Innovation and Technology, Washington State, 2003). A growing cluster of businesses specializing in computer networks and applications, including Cisco Systems, F5 Networks, World Wide Packets, Telect, Agilent, XN Technologies and Vivato has now emerged in the Spokane metropolitan area that will have increased workforce requirements as these businesses expand.

- The Electrical Engineering field is projected to be a fast growing occupation over the 2000-10 period, with a projected growth rate of 10-20%, according to the 2002-2003 Bureau of Labor Statistics’ Occupational Outlook Handbook. For the State of Washington, the growth of the Electrical Engineering field is also projected to be one of the higher demand fields. Among the reasons for this increase is the continuing growth of both e-commerce and the technological tools being used by businesses to track it. For example, personal data acquisition devices are now able to track shipments, supply costs and inventory of most business, all in real time. For that and many other reasons almost all industries are quickly becoming dependent on electrical engineers, who will design, operate, and/or maintain their systems. The consumer has also felt the impact of these changes. Everything from smart appliances to drive-by-wire automobiles have been developed and by teams including electrical engineers.

- Washington State has many electronic, software, and engineering companies such as Itron, Keytronics, Itronixs, Agilent Technologies, Oracle, Microsoft, Cisco/Nortel, Graybar, World Wide Packets, INTEL, Fluke, Boeing, Telect, Bayliner, Schweitzer Engineering, Bremerton Shipyards, Pacific Northwest National Laboratory, AVISTA, Bonneville Power Administration, Inland Power and Light, and MC Engineering that need a technologically well-educated workforce. These and other companies in the state and region currently employ EWU graduates in a variety of technical fields and they continue to request graduates with solid backgrounds in Electrical Engineering and the ability to integrate engineering processes with software design.

- Technology companies will be challenged to find the skilled professionals they require when the economy recovers to advance projects that are currently on hold. When companies are able to move forward there will be a rapid turnaround in the number of employment opportunities and EWU Electrical Engineering graduates must be available.

- Increased applications of the computing and engineering sciences to defense and warfare systems has established a greater workforce need in government and defense.

- Only 10% of the Spokane high technology workforce is drawn from the local population, while a high percentage of jobs continue to be filled with foreign workers in H1B status. Few qualified candidates at any level exist locally to fill positions in areas of software, hardware, networks, databases, and electronics (INTEC).

- The most recent statistics from Washington State Employment Security Department (June 2002) show that the need for Electrical Engineering employment will grow annually by 2.3% in Seattle-King County between 2005 and 2010.

Additionally, Washington State engineering schools currently turn away hundreds of prospective Electrical Engineering students each year. For example, the Department of Electrical Engineering at UW typically receives 350 to 400 applications per year and admits only 200. (UW Electrical Engineering Department) Many of these students who are unable to enroll in the UW Electrical Engineering program may wish to attend another Electrical Engineering degree program in the vicinity of UW. From the above it can be seen that nearly 200 students wishing to enroll in Electrical Engineering are unable to do so. It also implies that the student demand for an Electrical Engineering degree is extremely high.

Why does Eastern Washington University need to offer an Electrical Engineering degree?

The 2003 Washington State Legislature approved and Governor Lock signed into law EHB 1808 which provides the opportunity for all state universities to offer Electrical Engineering programs. The Departments of Engineering Technology and Multimedia Design and Computer Science are anticipating the construction of a new building. In light of the changes in the State law, the building has been designed to include laboratories that will support a curriculum for an Electrical Engineering degree.

Eastern Washington University (EWU) saw itself in the unique position of being poised to meet the demands of industry, follow the recommendations of the AEA task force, and provide the additional capacity called for by the Higher Education Coordinating Board and Governor Locke. In addition, the College of Science, Mathematics and Technology at EWU began a process of reorganizing and redeveloping the programs in its departments of

Engineering Technology and Multimedia Design, Computer Science and Physics in response to the current workforce needs particularly as they applied to the regional technology sector. To this end, the faculties of these departments united within a new academic unit named the School of Computing and Engineering Sciences where interdependent programs can focus on student learning within the context of the ever-increasing demand for technology connected degrees. Seeing the benefit of a new academic unit at EWU, the Washington State legislature has now funded the design of a new state-of-the-art building to house the school and its programs.

The doors to the school's new facility, housing 15 classrooms (three of which will be wired for distance education) and 21 laboratories, with many spaces designed for interaction and collaboration between departments, should open in 2005. With more space (93,000 gross square feet and 60,000 assignable square feet), Eastern can serve 78% more students in the Department of Engineering Technology and Multimedia Design, increase enrollment by 21% in Computer Science, and serve 28% more students in Physics. With an eye toward the future, the new facility has been designed to accommodate students and faculty based on projections for enrollment in 2010. Laboratories will be furnished with the latest equipment giving students the opportunities they need to understand and use these technologies as professionals. Specialized labs and equipment will also help faculty further their research and foster industry partnerships, with the goal of leading to new technologies and new applications for current technology.

By creating the School of Computing and Engineering Sciences with Accreditation Board for Engineering and Technology (ABET) accredited programs in engineering technology and computer science and existing programs in computer information systems and physics, Eastern seeks to develop, fund, and offer new bachelor's and masters' programs responsive to students and employers i.e. electrical engineering.

The trend in engineering education is to converge technological education and liberal arts education (Rosalind Williams, Chronicle of Higher Education, January 24, 2003). This article further states that students need to "be prepared for a life in a world where technological, scientific, humanistic and social issues are all mixed together". EWU's Vision 2010 calls for "convergence" of scientific and liberal arts education. Placing an Electrical Engineering program in this type of educational environment will enhance student learning.

Why does Eastern Washington need to offer an Electrical Engineering degree at North Seattle Community College?

As described above, a tremendous shortage of engineers exists in Washington State while WSU and UW are not increasing their electrical engineer graduation rates. In light of this, additional public baccalaureate Electrical Engineering student capacity is needed in the State. As the largest potential for Electrical Engineering students exist in the Puget Sound region it seems appropriate to conduct an additional Electrical Engineering program in Seattle. At the same time, electrical/electronics laboratories have been created in North Seattle Community College (NSCC) and are currently greatly under utilized. A recent survey of these facilities indicated that they are generally adequate to begin offering an Electrical Engineering program at this site. Eastern Washington University has been in discussions with North Seattle Community College to utilize these facilities for the Electrical Engineering program.

Further, Eastern Washington University has been successfully providing distance education programs in Technology to Walla Walla Community College, Clark College, and South Seattle Community College for some time. EWU has been conducting ABET accredited Computer and Mechanical Engineering Technology Programs for more than a decade on the main campus.

An email from Loretta Seppanen Assistant Director of Educational Services for the Washington State Board for Community and Technical Colleges stated that, "Each year about 100 students from CTCs transfer into electrical engineering at UW and WSU - - they account for 45% (91 out of 204 for class of 2000-01) of the graduates of the electrical engineering program. The number could be higher. A year ago Bellevue CC funded a phone survey of their former transfer students and found that for the small group that had not yet transferred, electrical engineering was the 6th most listed potential major - signaling students prepared for and waiting for the opportunity to enter this field. Based on the BCC survey, I estimate that some 100 students a year seek or would seek entrance to a publicly funded electrical engineering program, but are either not admitted to the program of their choice or do not apply because of the highly competitive nature of that program. More than half these students are from the Puget Sound area and thus likely candidates for a program in King county." This indicates the potential for a great deal of demand especially in the Puget Sound area. The EWU program could easily fill 35-40 % of this need.

Loretta Seppanen further estimates “that for every three student currently accepted in transfer to an electrical engineering program, another student is looking for a program spot that meets their need (perhaps due to being place bound, low income or with a lower GPA than needed for the current competitive programs).” She further stated, “transfers at community colleges are expected to grow by 5 percent a year.” Applying this analogy to the historical trends she prepared Table 1 indicating anticipated demand for the EWU electrical engineering program.

Table 1. Forecasted Annual Transfers Seeking EE program (Above level currently being accepted)

	2004	2005	2006	2007	2008	2009	2010
Feeder Colleges to NSCC Area*	36	38	40	42	44	46	48
Feeder Colleges to Cheney Campus**			17	17	18	19	20

*Key feeder colleges: Seattle District, BCC, Shoreline, Highline
*Other feeder colleges: Edmonds, Everett, Green River, Tacoma, Pierce District
**Spokane District, CBC, YVCC, Walla Walla

1.2.2 Capacity

Does Eastern have the institutional capacity to support a high-quality degree program in Electrical Engineering?

As described above, Eastern Washington University is constructing a new campus facility. This facility will house the Department of Engineering Technology and Multimedia Design. This facility with its leading edge technology will accommodate the Electrical Engineering program on the Cheney campus. The North Seattle Community College campus has digital/electronics laboratory stations available that will accommodate an estimated total enrollment of 96 students. This laboratory is currently not utilized in the afternoons. Anticipated students include 30-35 Juniors with approximately 15-20 graduates/year on EWU campus and 25-30 Juniors with approximately 20-25 graduates/year on North Seattle Community College campus. The cost of the program is estimated to be $6,700/Full Time Equivalent (FTE) Students, once steady state is reached. Program expenses will include cost of three faculty members, program coordination and support on EWU’s campus and North Seattle Community College campus, operational costs at EWU and North Seattle Community College campuses, travel between campuses, ABET accreditation, equipment, and part-time instructors. (See Table 4, page 15, for more detail.)

1.3 Relationship to Other Institutions

1.3.1 Duplication

There are six other Electrical Engineering programs in the State of Washington, two of which are public institutions (University of Washington and Washington State University). The four private universities are Gonzaga University, Seattle University, Walla Walla College, and Seattle Pacific University. The only institutions that are located in eastern Washington are Gonzaga University (Spokane), Washington State University (Pullman), and Walla Walla College. The rest of the universities are in the western side of the State (Seattle). All of these programs present curricula which comply with the requirements of the Accreditation Board for Engineering and Technology (ABET). While there is a clear trend showing rising job markets in the State, Electrical Engineering programs have not increased the number of graduates, thus not meeting the need of industry. EWU’s curriculum has been designed to match the requirements of ABET, to meet the needs of local industry, and to be consistent with similar programs in the country.

1.3.2 Uniqueness.

The uniqueness of the Electrical Engineering program at Eastern Washington University is threefold. First, it will graduate students that are well prepared in the electrical engineering science, but that will also be proficient in the laboratory, i.e. it will have an extensive “hands-on” segment blended into the curriculum. Laboratories will be included in more classes than any other four-year program in the state. Further, the faculty will consist of people who have considerable industrial experience, thus easing student transition from the academic to the industrial environment. Moreover, industry contacts already exist as a result of over a decade of EWU offering an ABET accredited Computer Engineering Technology program will benefit Electrical Engineering students. EWU has conducted a pre-engineering program for the past several decades as well.

Second, the EWU Electrical Engineering program will be offered in two locations: Seattle and Cheney. This not only targets the two most technologically advanced regions in the state, but also includes the two areas that currently have the largest need of engineers in the State. Further, the fact that no state universities offering Bachelor of Science degrees in Electrical Engineering are present in the Spokane area has presented a barrier for educating place-bound potential students. Although there are three Electrical Engineering programs currently in place in Seattle, the only state university that offers an Electrical Engineering program is the UW, which turns away 150-200 students every year. While the cost of the program at EWU will be, including overhead, \$10000-\$12000/FTE at steady state, the minimum cost of the other programs in the state is \$17000/FTE. This implies an Electrical Engineering program will be accessible to a larger pool of students previously blocked due to costs. As EWU faculty members typically carry a larger instructional load than research institutions and therefore undertake less research than research institutions, the cost per student is less.

Third, EWU's program will offer non-traditional classes for students that are not only place-bound to Seattle and Spokane, but that also currently hold a job in industry and cannot attend classes with a "traditional" schedule. Further, EWU will expand efforts to target audiences that are not traditional at engineering programs, such as women and ethnic minorities. EWU has a strong recruitment and retention policy for such underrepresented groups.

II. Program Description

2.1 Goals, Objectives, Student Learning Outcomes.

The mission statement of the Electrical Engineering Program at Eastern Washington University reads as follows:

> "The mission of the Electrical Engineering Program at Eastern Washington University is to provide a comprehensive education utilizing the classroom, applied research, experience-based learning, and extensive laboratory experience. Additionally, students will be encouraged and challenged to investigate, innovate, incorporate and implement engineering knowledge into the solution of today's technological problems."

2.1.1 Goals and Objectives

The Electrical Engineering program at Eastern Washington University will promote both professional and personal development of its students. Graduates will be skilled in engineering and ready to become productive contributors in their field and to society.

Specific goals and objectives of the Electrical Engineering program are to have graduates that have:

- The ability to demonstrate knowledge of mathematics, the basic sciences, and the engineering sciences.
- The ability to demonstrate theoretical and practical understanding of complex design problems as applied to electrical engineering systems using analytical and simulation skills.
- The ability to demonstrate and conduct laboratory experiments to implement their engineering designs and the ability to relate experimental results to a theoretical understanding.
- The ability to demonstrate the design of a component, circuit, system, and/or process to meet stated requirements.
- The ability to identify, design, and implement solutions to difficult engineering problems that take advantage of technical opportunities.
- The ability to demonstrate the use of techniques, skills, and modern engineering tools necessary for successful engineering practice.
- The ability to demonstrate proficiency in oral and written communication skills and effective teamwork skills.

- The ability to understand their personal, professional and ethical responsibilities as applied to contemporary issues for both the engineering profession and society.
- The ability to understand the necessity for lifelong learning to maintain professional viability and be prepared to continue their formal education.

2.1.2 Outcomes

Upon successful completion of the Eastern Washington University Electrical Engineering program, graduates will:

- Understand and be capable of applying mathematics, physical science, engineering science, and related disciplines.
- Understand and be capable of applying principles of electrical engineering practice and process subject to stated and realistic constraints.
- Be able to understand, analyze, document, and track electrical engineering requirements.
- Be able to design, implement, and maintain electrical engineering components, circuits, processes, and systems.
- Be able to verify and validate electrical engineering components, circuits, processes, and systems.
- Have an awareness and understanding of current industry standards and practices.
- Be able to function on multi-disciplinary teams and effectively communicate technical information to non-technical personnel.
- Understand and apply principles of team process and project management.
- Have strong oral and written communication skills.
- Be capable of independent life long learning to keep their skills current.
- Understand professional responsibility and the application of ethical engineering principles and practices.
- Have a basic knowledge of economics, humanities, and social sciences.

2.2 Curriculum

2.2.1 Course of Study

The curriculum consists of 12 sequenced quarters of full time attendance, with a minimum of 180 credits for graduation. Basic sciences courses (Mathematics, Physics, and Chemistry), general education requirements, and introductory circuits and programming classes are included in the first two years of studies. This will allow both for easy transferring for community college students, and for preparing the student for the engineering intensive junior and senior years. This approach is consistent with the existing pre-engineering program currently offered at EWU and NSCC. No new classes will need to be created at either institution for the first two years of the proposed curriculum.

The junior year will include classes in all branches of the electrical engineering field: electronics, advanced circuit analysis, communication and control systems, power systems, electromagnetics, digital systems, and microprocessor systems. The junior year will address basic design criteria and provide a solid theoretical background, building into the senior year. The senior year will emphasize the practical side of the curriculum, providing electives in several areas and a mandatory senior project. The senior project will consist of a team-based end-to-end project that will closely simulate the industrial environment in which the students will later practice engineering.

The proposed areas of specialization are congruent with the needs of industry and therefore the anticipated specialty of the full time professors of the program:

a. Digital Signal Processing and/or Communication Systems,
b. Microelectronics and/or VLSI Design,
c. Control Systems.

A sequence of elective courses will be offered in each of these areas of emphasis. The senior project will be congruent with the field of expertise chosen by the student. The term-by-term curriculum and individual course syllabi are included in Appendix I, page 39.

2.2.2 Admission Requirements

To be considered for admission to the Electrical Engineering Program, students must:
- qualify for admission to Eastern Washington University,
- have completed MATH 162 (Calculus II) or equivalent, PHYS 152 (Physics II) or equivalent, CSCD 225 (Programming Principles I) or equivalent,

2.2.3 Course Sharing

Eastern Washington University and Seattle Community Colleges will partner to offer the Electrical Engineering program. In Fall 2004 the junior year is proposed to begin on the North Seattle Community College campus. Courses will be taught face-to-face on site as well as over the K-20 network from the EWU campus. In Fall 2005 junior and senior classes will be offered. In Fall 2006 the junior year will begin on the EWU campus. Courses will be taught face to face on both sites as well as over the network from the EWU campus and the NSCC campus. These classes will be broadcasted through specialized distance education classrooms to and from both the EWU and NSCC campuses. Students will have the option to complete the first two years (i.e. general education requirements, science (mathematics, chemistry, physics) requirements, and programming requirements) either at EWU or at a community college. Appendices II and III display four-year plans for students transferring from the North, South, and Central Seattle Community Colleges and Spokane Falls Community College. Other community college four-year plans are currently under development.

2.2.4 ABET Requirements

The Electrical Engineering curriculum at Eastern Washington University has been designed following the guidelines for accreditation by the Accreditation Board for Engineering and Technology (ABET). A list of requirements follows:

i) **Students**. EWU has in place policies for acceptance of transfer students from all Community Colleges in the State of Washington and from other institutions. Example 4-yr plans with North Seattle Community College and Spokane Falls Community College are shown in Appendices II, page 71, and III, page 73, respectively. Continual student evaluation takes place to ensure students are meeting educational objectives.

ii) **Program Educational Objectives.** Detailed educational objectives, congruent with EWU's mission, are listed in Section 2.1.1. The curriculum was designed to achieve the objectives listed above, while keeping an ongoing curriculum evaluation with the cooperation of the advisory board.

iii) **Program Outcome and Assessment.** A complete description of the assessment plan devised for the Electrical Engineering program is given in Section III. All ABET requirements are addressed and fulfilled.

iv) **Professional Component.** The professional component of the curriculum includes:
   a. One year of a combination of mathematics, chemistry (with laboratory component), physics (with laboratory component).
   b. One and a half years of engineering design and engineering science.
   c. A complete general education component to complement the technical complement of the curriculum.

v) **Faculty**. Three full-time faculty with a diverse background and appropriate qualifications and engineering experience will guarantee fulfillment of this requirement.

vi) **Facilities.** Section 2.3 details the facilities to be utilized by the Electrical Engineering program.

vii) **Program Criteria.** The curriculum entails both breadth and depth across the Electrical Engineering field. An itemized description, consistent with ABET requirements, shows that the program contains the following:
   a. Knowledge of probability and statistics, from MATH 380 or MATH 385, complemented with applications intrinsic of each engineering course.
   b. Knowledge of mathematics through differential and integral calculus, obtained from:
      - MATH 161, MATH 162, MATH 163, MATH 241, the complete four-quarter calculus sequence (which includes Multivariable Calculus).
      - MATH 347 (Differential Equations)
   c. Basic sciences. The following classes are enforced in the curriculum:

- PHYS 151, PHYS 152, PHYS 153, PHYS 161, PHYS 162, PHYS 163, PHYS 164, PHYS 221, a complete four-quarter sequence of Physics fundamentals with, each with an experimental component.
- CHEM 151, General Chemistry with laboratory component.

d) Computer Science. The following computer classes are mandatory for graduation:
- CSCD 225, CSCD 205, six credits of programming principles with a laboratory component.
- CSCD 226, five credits that continue CSCD 225.

e) Engineering Sciences. The curriculum includes core classes necessary to analyze and design electrical and electronic devices, software and systems containing software and hardware components. An itemized list of the core courses follows:
- Analog Circuits (ENGR 209 and ENGR 210), include laboratory component.
- Digital Circuits (ENGR 160 and ENGR 250), include laboratory component.
- Electronics (ENGR 330, ENGR 331), includes laboratory component.
- Signals and Systems (ENGR 320 and ENGR321), includes laboratory component.
- Microprocessors (ENGR 260), includes laboratory component.
- Energy Systems (ENGR350).
- Electromagnetism (PHYS 401).
- Capstone Design (ENGR490), culminates the curriculum with a major design experience.

f) Advanced mathematics, including:
- Differential equations, in Mathematics, Physics, Analog Circuits, Electronics, and Signal and System core courses.
- Linear algebra, in Mathematics, Analog Circuits, Electromagnetics, and Signal and Systems classes.
- Complex variables, in Mathematics, Physics, Electromagnetics and Signal and Systems classes.
- Discrete mathematics, in Digital Circuits and Microprocessors classes.

2.3 Use of Technology

Courses will be taught using a variety of instructional methods. Regardless of whether lecture or laboratory is used, material will be presented using the latest technology. While traditional lectures will be the major form of education, these lectures will be broadcasted through the K-20 satellite link between Cheney and North Seattle Community College. The Department of Engineering Technology and Multimedia Design has being using this instructional method for several years, with highly successful results. As a result of the construction of the new building for the School of Engineering and Computing Sciences, three classrooms with state-of-the-art distance education infrastructure will be available, easing the task at hand.

Current laboratories include: (Refer to Appendices IV and V, pages 75 and 79 respectively)
- Control / Robotics lab. Numerous industrial robots and small-size autonomous moving robots. PC stations with various I/O equipments and PLCs (Programmable Logic Controllers).
- Digital and analog circuits. Traditional circuit and electronics laboratories are available, including several spectrum analyzers, digital and analog oscilloscopes, logic analyzers, pulse generators, function generators, frequency counters, variable power supplies, and a large variety of accessories. PCs with Xilinx software and Agilent boards are available for VHDL programming of FPGA chips.
- Microprocessor lab. PC stations connected to Motorola's 68HC11 microprocessor testing board are available. This equipment is incorporated into the current Digital and Circuit labs.
- Communication systems / DSP (Digital Signal Processing) lab. Including GHz spectrum analyzers, RF test sets, network analyzers, and digital oscilloscopes. PC stations with full versions of Matlab including all pertinent toolboxes. These two labs are also incorporated into current Digital and Circuit labs.
- Network lab. Numerous routers, switches, servers, firewalls, and network core that will enable students to work with various computer configurations. Equipment for Cisco Certified Network Associate (CCNA) and Cisco Certified Network Professional (CCNP) are available.
- PC labs. PC stations with numerous software such as C/C++ complier, graphic design tools, and circuit simulation tools.

Laboratories that are being planned and nearly in the implementation process include:

- VLSI lab. Unix workstations with full versions of Mentor Graphics will be included.
- Power Systems lab. This lab will include induction, synchronous, and dc machines., transformers, protection relay, and computer software for system simulation.

North Seattle Community College has laboratories similar to those existing at EWU, except for the VLSI lab. However, since VLSI labs are mostly computer based, EWU servers will allow direct access from NSCC. Agreements have been reached with NSCC for the usage of laboratories on its campus. Currently the laboratories are used until 1pm and at evening sessions. The Electrical Engineering curriculum would fill the unused gap in the afternoon.

All students will have access to high-speed internet in the classroom and teaching laboratories, allowing them to link to the EWU library system, as well as a variety of other resources intrinsic to the Internet.

It is important to note that at least one faculty will be assigned full time at the NSCC campus. The Seattle-based faculty will be in charge of advising students, monitoring laboratories, conducting help sessions, and serving as a liaison with industrial partners.

2.4 Faculty Profiles

There will be three full time faculty members dedicated to the Electrical Engineering program, and as many adjunct faculty as needed. All full time faculty will hold a Ph. D. in Electrical Engineering or a related field. Close interaction with industrial and professional practitioners will be required. Faculty qualifications required by ABET will be strictly enforced. Faculty will be encouraged to advise students in projects that include traditional and applied research. The expertise for these faculty are shown below:

The first faculty position will have a background in Signal Processing and/or Communication Systems. He/she will be in charge of teaching core and elective courses (lecture and lab) related to Signal Processing, Communication Systems, Digital Circuits, Microprocessors, Digital Signal Processing, and Control Systems.

The second faculty must have a background related to VLSI design and/or Microelectronics. He/She will teach several courses related to VLSI design and analog integrated circuit design such as Circuits, Electronics, Analog Integrated Circuits, Semiconductor Device Theory including related laboratory classes.

The third faculty needs a background in Wireless Communications, Signal Processing, Computer Engineering, and/or Electronics. This faculty will be in charge of teaching core and elective courses (lecture and lab) related to Communication Systems, Computer Architecture, Electromagnetics, Digital Circuits, Microprocessors, and Digital Signal Processing.

As previously stated, lower division pre-engineering coursework typically exists at many community college campuses and at EWU. On the EWU campus current faculty will teach several existing pre-engineering courses that are regularly taught for pre-engineering students, Computer Science and Computer Engineering Technology majors. Technical writing and cultural/gender diversity courses are currently offered at the community colleges and EWU. The International Studies requirement (TECH 393) is currently available over the K-20 network. Table 2 summarizes the existing and future faculty needs. Resumes of current faculty are shown in Appendix VI, page 83.

Table 2. Full time program faculty

Name	Rank	Status	% Effort in Program
Min-Sung Koh	Assistant Professor	Full Time	100%
Position to be Filled Fall 2004	Assistant Professor	Full Time	100%
Position to be Filled Fall 2006	Assistant Professor	Full Time	100%
William Loendorf	Assistant Professor	Full Time	Pre-engineering
Esteban Rodriguez-Marek	Assistant Professor	Full Time	Pre-engineering
New FTE Faculty	2.0 (2004) or 3.0 (2006)		

2.5 Students

2.5.1 Projected enrollments

The program will start with a junior year contingent of students at NSCC in Fall 2004. (See Table 3.) In the Fall of 2006 Electrical Engineering offering will begin at EWU's campus. The initial class is expected to be of 25 students, with the following years having 20 students both for junior and senior classes. Again, Fall 2006 quarter will see the incorporation of Electrical Engineering at junior level on EWU's campus. (This explains the surge of student numbers for that quarter.) The Electrical Engineering program at NSCC is expected to fill up after the first two years. The number of students at NSCC is expected to rise with some of the overfill relocating to Eastern for the last two years of study. This accounts for the surge of FTEs after the first two years of offering the program. Accreditation by ABET must wait until the first graduating class. Table 3 summarizes the projected full time student enrollments for the first 5 years. Note that the expected pool of students attending the program at the NSCC campus is not restricted to current NSCC students, but includes potential students in pre-engineering from other community colleges in the region unable to enter the University of Washington or private institutions in the region.

Table 3. Size of Program (Junior and Senior Years)

Number of Students	**Fall 2004**	**Fall 2005**	**Fall 2006**	**Fall 2007***	**Fall 2008***
EWU	0	0	20	30	30
NSCC	25	40	40	40	40
Total Headcount	25	40	60	70	70
FTE	25	40	60	70	70

*Full enrollment

2.5.2 Time to degree

The junior and senior years of the program will consist of six consecutive quarters, with students typically entering fall quarter and graduating spring quarter of the second year.

2.5.3 Diversity

Eastern Washington University has a strong recruitment program for underrepresented groups in engineering and technology. These groups include women, ethnic minorities, older students, and displaced workers. Aggressive recruitment strategies are currently being set up in a concurrent effort between the Department of Engineering Technology and Multimedia Design and the Office of Admissions of EWU. The University maintains an office of Disability Support Services to assist students with special needs and offers a variety of academic support services. Similarly, the African American, American Indian, Chicano Education, and Women's Studies programs offer support services to their respective client groups. To assist non-traditional students, the University offers on-campus daycare facilities and the HOME (Helping Ourselves Means Education). We anticipate our student population to be reflective of the local population. North Seattle Community College has a variety of support services that connect the students to the North Seattle Community College campus as well. These include excellent transfer student advising, peer mentoring, cultural cohorts program, and transition support.

2.6 Administration

The Department Chair has 25% assigned time for administrative responsibilities for the Electrical Engineering program. One person will be assigned 25% time for directing operations at the NSCC campus. This is summarized in Table 4.

Table 4. Administrative/Support Staff

Name	Title	Responsibilities	%Effort in Program
Michael Brzoska	Professor and Department Chair	Administers all Program aspects	25%
To be assigned	Professor and Program Coordinator	Coordinate all aspects of the program on the NSCC campus	25%
To be assigned	Secretaries	Oversee department offices activities on the EWU campus and NSCC campus	50%
To be assigned	Technicians	Support laboratory activities on the EWU campus and NSCC campus	50%
Total FTE Staff			1.5

III. Assessment

Assessment of the Electrical Engineering curriculum, program, and faculty is coordinated by the department chair. Course evaluations are completed by students for all courses each term. Program and faculty evaluations are to be consistent with the policies of the College of Science, Mathematics and Technology. Student outcome assessments follow ABET guidelines (Accreditation Board for Engineering and Technology) for continued accreditation. An advisory board is being organized to provide program feedback and build relationships. The ABET review process will give an indication of EWU's Electrical Engineering program viability. This will occur in 2006 after the first graduating class.

3.1 Assessment Plan

The program is assessed according to the following principles and policies:

Structure: Physical plant, material resources, goals and objectives, courses, human resources (faculty, staff, students).

Process: Implementation of the curriculum including the teaching/learning process, budget implementation, and daily operations.

Outcomes: Student performance and indicators that reflect achievement of the academic mission.

Specifically:

1. Full-time faculty members have the final responsibility for additions, deletions, changes or modifications to the program in all areas of structure and process as well as decisions related to outcomes. No changes of a substantive nature are made without an opportunity for all full time faculty to have input.
2. A curriculum committee will be the vehicle through which formal curriculum input occurs and through which formal changes will be instituted.
3. The program and curriculum will be evaluated informally throughout the academic year by the full time faculty, and formally following each quarter in faculty meetings. An annual session will be scheduled for addressing assessment issues.
4. Program faculty believe that assessment requires accountability to all communities of interest. All communities of interest will be afforded opportunities to give both formal and informal input related to areas of structure, process, and/or outcomes as appropriate. Communities of interest include the following:
   - Academic full-time faculty
   - Academic part-time faculty
   - Alumni
   - Enrolled students
   - Internal university administrators

- Administrators external to the University
- Academic faculty from other EWU departments servicing the EWU program
- Adjunct faculty
- Guest lecturers
- Professional Advisory Committee (members include professionals from the engineering community)
- Employers of graduates
- State of Washington

5. All communities of interest are encouraged to give input on an informal basis at anytime.
6. The policy will undergo an annual review.

3.2 Student Learning Outcomes Assessment Plan

Student learning is assessed in individual courses through measurable objectives ~~for each course~~. Assessment items include grades on exams taken during the course, final exam grade, evaluation of lab reports, employer and student surveys, and the formal evaluation of engineering projects.

The outcome of the student's application of academic learning in the Electrical Engineering professional setting is measured by utilizing the six objectives listed below. The methods of assessment include the statistical spread of students' final grades in appropriate courses and mail/telephone survey results from employers of recent graduates.

The results of these assessments are used to insure that the Electrical Engineering program is fulfilling its mission statement, to continually improve the program, and to allow the program to be dynamic in order to graduate Electrical Engineers prepared for future design, development, and implementation challenges.

Objective 1: To have the students demonstrate their ability to understand and utilize Electrical Engineering knowledge.

Outcome 1: To have the students demonstrate their ability to understand Electrical Engineering terminology and processes. (TC2K of ABET Criteria a, b, c, d, & e)

Assessment method 1a: Distribution of students' final grades in ENGR 210 – Electrical Engineering Circuits II Course.

Assessment method 1b: Survey results from employers of recent graduates.

Outcome 2: To have the students demonstrate their ability to understand industrial engineering concepts. (TC2K of ABET Criteria e, & h)

Assessment method 2a: Distribution of students' final grades in ENGR 331 – Electrical Engineering Electronics II Course.

Assessment method 2b: Survey results from employers of recent graduates.

Objective 2: To have the student demonstrate their ability to use applied electrical engineering knowledge.

Outcome 1: To have the students apply learned knowledge to practical problems and adapt to emerging applications of mathematics, science, engineering and technology. (TC2K of ABET Criteria a, b, c, d, & e)

Assessment method 1a: Distribution of students' final grades in ENGR 490 – Electrical Engineering Capstone Course.

Assessment method 1b: Survey results from employers of recent graduates.

Outcome 2: To have the students use typical Electrical Engineering tools, hardware, and software in an efficient manner. (TC2K of ABET Criteria a, b, c, & k)

Assessment method 2a: Distribution of students' final grades in ENGR 490 – Electrical Engineering Capstone Course.

Assessment method 2b: Survey results from employers of recent graduates.

Outcome 3: To have the students conduct, analyze and interpret experiments and apply experimental results to improve Electrical Engineering products and processes. (TC2K of ABET Criterion b, e, & k)

Assessment method 3a: Distribution of students' final grades in ENGR 321 – Electrical Engineering Signals and Systems II Course.

Assessment method 3b: Survey results from employers of recent graduates.

Objective 3: To have the students apply and improve their Electrical Engineering problem solving and thinking abilities.

Outcome 1: To have the students be able to evaluate a problem and bring general design strategies to bear on it with a commitment to quality, timeliness, and continuous improvement. (TC2K of ABET a, b, c, e, & k)

Assessment method 1a: Distribution of students' final grades in ENGR 331 – Electrical Engineering Electronics II Course.

Assessment method 1b: Survey results from employers of recent graduates.

Assessment method 1c: Department faculty evaluation of projects in ENGR 331 – Electrical Engineering Electronics II Course.

Outcome 2: To have the students be able to plan and coordinate a project and manage systems. (TC2K of ABET Criteria c, d, e, f, & g)

Assessment method 2a: Distribution of students' final grades in ENGR 490 – Electrical Engineering Capstone Course.

Assessment method 2b: Survey results from employers of recent graduates.

Objective 4: To have students demonstrate their professional, societal, individual, and workgroup skills.

Outcome 1: To have the students demonstrate their ability to function effectively on teams. (TC2K of ABET Criterion d, & g)

Assessment method 1a: Distribution of students' evaluations of peers in ENGR 490 – Electrical Engineering Capstone Course.

Assessment method 1b: Survey results from employers of recent graduates.

Outcome 2: To have the students understand professional, ethical and social responsibilities. To have the students demonstrate respect for diversity and a knowledge of contemporary professional, societal and global issues. (TC2K of ABET Criteria f, h, & j)

Assessment method 2a: Distribution of students' final grades in TECH 393 – Technology in World Civilization Course.

Assessment method 2b: Survey results from employers of recent graduates.

Outcome 3: To have the students recognize a need for, and demonstrate an ability to engage in lifelong learning. (TC2K of ABET Criterion i)

Assessment method 3a: Survey of faculty and students to determine the level of involvement in TECH Club, IEEE.

Assessment method 3b: Survey results from recent graduates.

Objective 5: To have students demonstrate their ability to communicate effectively.

Outcome 1: To have the students write clearly and concisely to a variety of audiences. (TC2K of ABET Criterion h, & g)

Assessment method 1a: Distribution of students' grades on essays and reports in TECH 393 – Technology in World Civilization Course.

Assessment method 1b: Distribution of students' grades on laboratory reports in ENGR 210 – Circuits II Course.

Assessment method 1c: Survey results from employers of recent graduates.

Outcome 2: To have the students communicate verbally, give presentations, demonstrate skills related to persuasion, listening and the consideration of other points of view, appropriate for industry. (TC2K of ABET Criterion f, & g)

Assessment method 2a: Distribution of students' grades on final formal design team project presentation in ENGR 490 – Electrical Engineering Capstone Course.

Assessment method 2b: Survey results from employers of recent graduates.

Objective 6: To fulfill the need for Electrical Engineering graduates in the Northwest Region.

Outcome 1: To have faculty and students involved with the Advisory Board. (TC2K of ABET Criterion h, & j)

Assessment method 1a: Survey faculty and students to determine the level of involvement in Advisory Board, TECH Club, regional companies, and IEEE.

Assessment method 1b: Review recent graduate survey forms to determine the extent of working relationships.

If a student has met the academic criteria, as described in this section, the program considers the student to have met the curricular goals of the Electrical Engineering program.

IV. Finances

No new state funds are being requested to implement the Electrical Engineering program. A summary of program costs is presented in Table 5.

Table 5. Summary of program costs – Year 1 (2004/2005) to steady state (2007/2008)

Line Item	Internal Reallocation	New State Funds	Other Sources	2004/ 2005[1]	2005 /2006	2006/ 2007[2]	2007/ 2008[5]	2008/ 2009
Administrative Salaries (.50 FTE Benefits @27%)[3]	44,500	0		44,500	44,500	44,500	45,835	45,835
Faculty Salaries (3 FTE Benefits @27%)[4]	276,225	0		184,150	276,225	276,225	284,512	284,512
Clerical Salaries (.5 FTE Benefits @32%)[3]	19,800	0		19,800	19,800	19,800	20,394	20,394
Technician Salaries (.5 FTE Benefits @32%)[3]	23,760	0		23,760	23,760	23,760	24,473	24,473
Goods and Services	35,000	0		35,000	35,000	35,000	35,000	35,000
Travel	8,000	0		8,000	8,000	8,000	8,000	8,000
Equipment Replacement and Maintenance	60,000	0		60,000	60,000	60,000	60,000	60,000
ABET Costs	2,000	0				2,000	2,000	2,000
TOTAL COST	469,285	0		375,210	467,285	469,285	480,214	480,214
FTE Students				25	40	60	70	70
Cost per FTE Student[6]				15008	11682	7821	6860	6860

1. Program starts at NSCC.
2. EWU on campus program starts.
3. 25% on EWU campus and 25% on NSCC campus.
4. Faculty located on EWU campus and/or NSCC campus.
5. Includes a 3% pay increase.
6. Does not include $3509 incremental cost (indirect cost).

V. Additional Proposal Elements (HECB October 17, 2003 Letter)

5.1 Background Information

Describe the program accreditation requirements that are based on the national accreditation standards established by the Accrediting Board for Engineering and Technology.

These requirements are shown in Section 2.2.4, page 11, ABET Requirements. The electrical engineering program has been designed to meet these requirements.

Identify occupations that typically require an undergraduate degree in electrical engineering. The Bureau of Labor statistics is one source for gathering this information.

Occupations that use the electrical engineering degree and the other degrees that serve these same occupations are listed in the Table 6.

Table 6. Electrical Engineering Occupations

Electrical Engineer	Design Engineer
Electronic Engineer	Research Engineer
Hardware Engineer	Test Engineer
Control Systems Engineer	Consulting Engineer
Power Systems Engineer	Engineering Management
Digital Systems Engineer	Engineering Professor
Communications Engineer	Applications Engineer
Computer Engineer	Systems Engineer
Software Engineer	Sales Engineer
Microprocessor Engineer	Project Engineer
Analytical Engineer	Quality Control Engineer
Experimental Engineer	

Only the main occupations that use electrical engineering degrees are listed in the above table, many more actually exist. Numerous peripheral occupations for electrical engineers would include corporate management, elected government officials, lawyers, doctors, scientists, professors, etc.

Identify the community colleges whose graduates will be recruited or are expected to enroll in the proposed program.

Community college transfer students into EWU's electrical engineering on the North Seattle Community campus are expected from North, Central, and South Seattle Community Colleges, Bellevue Community College, Edmonds Community College, Everett Community College, Highline Community College, Shoreline Community College, Green River Community College, Pierce College, Tacoma Community College, Skagit Valley College, and Clark College. Students from any community college that offers engineering transfer curricula may be eligible to enter into the program.

For the Cheney campus, Spokane Falls Community College, Columbia Basin College, North Idaho College, Yakima Valley Community College, and Walla Walla Community College would be the main feeder schools. Again, students from any community college that offers engineering transfer curricula maybe eligible to enter into the program.

5.2 Employer Demand and Community Need

Document employer demand in the state for the proposed program in terms of workforce needs of program graduates during the last 5 - 10 years and in terms of projected workforce needs of program graduates during the next 5 – 10 years.

Table 7 documents employment in the electrical engineering related fields in Washington State during the period 1997 to 2001. Table 8 provides long-term occupational projections for electrical engineers.

Table 7. Employment in Electrical Engineering related fields 1997-2001

Employment*	1997	1998	1999	2000	2001
Washington State					
Electrical Engineer	6420***	**	1810	3490	3,050

Electronic Engineers		**	**	3340	3,100
Computer Hardware Engineers	6580	6,870	250	1590	1,340

*Occupational Employment Statistics Survey, Bureau of Labor Statistics, Department of Labor, http://stats.bls.gov/oeshome.htm
** Data not available
*** Electrical and Electronic Engineers Combined

Table 8. Long Term Occupational Projections

Estimated Employment*	**2000**	**2005**	**2010**	**Annual Avg. Growth 2000-05**	Annual Avg. **Growth 2005-2010**
Washington State					
Electrical Engineers	3385	3587	3965	1.2%	2.0%
Electronics Engineers***	3511	3651	3940	0.8%	1.5%
Computer hardware engineers***	1690	1904	2217	2.4%	3.1%
Seattle-King County					
Electrical Engineers	1743	1854	2078	1.2%	2.3%
Electronic Engineers	1797	1870	2024	0.8%	1.6%
Computer Hardware engineers	1340	1546	1820	2.9%	3.3%
Eastern Washington					
Electrical Engineers	72	74	80	0.5%	1.4%
Spokane					
Electrical Engineers	299	310	346	0.7%	2.2%

*Occupational Employment Statistics Survey, Bureau of Labor Statistics, Department of Labor, http://www.wa.gov/esd/lmea/labrmarkt/occ/occXX.htm
***The electrical engineering degree provides course work in electronics and computer hardware. Therefore statistics on computer hardware engineers, electronics engineers, and electrical engineers were included.

Table 7 indicates that approximately 1000 additional electrical engineers are needed in Washington State between 2005 and 2010. The existing state electrical engineer graduation rate cannot keep pace with this growth.

Document demand in the state for the proposed program in terms of economic development.

Increasing the number and quality of students in the field of electrical engineering will help Washington State meet its economic development goals, and in fact EWU's Electrical Engineering program will provide an essential step in this process. Most economic studies for Eastern and Western Washington identify the continued strengthening of these regions' infrastructure for high technology business and industry as a major economic development strategy. For example, a May 2003 study by the Seattle-based Technology Alliance states that the State of Washington should be keeping up with our peer states in terms of technology but we are not. Washington ranks down the list among its peers in education. The study makes the point that Washington State does not produce the number of bachelor degrees necessary to lead and sustain the technology-based industries. The Report states, "The number of bachelor's degrees granted overall, and particularly in science and engineering majors, is in the lowest third of the nation on a per capital basis." It further states that technology thrives in states where education systems stress science and engineering, producing technologically sophisticated workers.

This position is corroborated by a 2000 report for the Sustainable Economic Development of the Spokane Area, which lists as one of its major strategic actions local education institutions expanding enrollments in "appropriate programs" to meet workforce needs in areas that included information technology, engineering, and software development. This same report also called upon the institutions of higher education to lend their services for specialized events, highlight the technology resources available to the region's business and industry, and collaborate with local technology-using companies to create internships and professional experiences for students. The Spokane Regional Comprehensive Economic Development Strategy (May 2003) identified the pursuit of "an aggressive comprehensive strategy to foster higher concentrations of technology jobs in the region" as a major objective for job and business development. This strategy also included a role for the area institutions of higher education. Only 10% of the Spokane high technology workforce is drawn from the local population, while a high percentage of jobs continue to be filled with foreign workers in H1B status. Few qualified candidates at any level exist locally to fill positions in areas of software, hardware, networks, databases, and electronics (INTEC).

The long-term occupational projections for electrical, electronic, and computer hardware engineers predict 1000 new positions in the state between 2005 and 2010. Currently state colleges and universities electrical engineering graduate rates cannot keep pace with this growth. The most recent statistics from Washington State Employment Security Department (June 2002—See Table 8, page 20) show that need for Electrical Engineering employment will grow annually by 2.2% in Spokane County, 1.4 % in eastern Washington, and 2.0 % in Washington State between 2005 and 2010. All occupations are expected to rise only about 0.8 % for each of the three locations. When companies are able to move forward there will be a rapid turnaround in the number of employment opportunities and EWU Electrical Engineering graduates must be available.

Among the reasons for this increase is the continuing growth of both e-commerce and the technological tools being used by businesses to track it. For example, personal data acquisition devices are now able to track shipments, supply costs and inventory of most business, all in real time. For that and many other reasons almost all industries are quickly becoming dependent on electrical engineers, who will design, operate, and/or maintain their systems. The consumer has also felt the impact of these changes. Everything from smart appliances to drive-by-wire automobiles have been developed and by teams including electrical engineers.

The aftermath of 9-11 has resulted in greater need for defense and warfare systems thus increasing applications of the computing and engineering sciences. This has resulted in a greater engineering workforce need in government and defense. Technology companies will be challenged to find the skilled professionals they require as the economy recovers to advance projects that are currently on hold.

Washington State has many electronic, software, and engineering companies such as Itron, Keytronics, Itronix, Agilent Technologies, Oracle, Microsoft, Cisco/Nortel, Graybar, World Wide Packets, INTEL, Fluke, Boeing, Telect, Bayliner, Schweitzer Engineering, Bremerton Shipyards, Pacific Northwest National Laboratory, AVISTA, Bonneville Power Administration, Inland Power and Light, Columbia Lighting, and MC Engineering that need a technologically well-educated workforce. These and other companies in the state and region including many consulting firms and state agencies currently employ EWU graduates in a variety of technical fields and they continue to request graduates with solid backgrounds in Electrical Engineering and the ability to integrate engineering processes with software design.

Compare electrical engineers' salaries in the state with those in other regions of the country as one indicator of relative supply and demand.

The latest data from the US Department of Labor Bureau of Labor Statistics show salaries for 2001. This data is shown in Table 9. Data for 2002 will be available later in 2003. Updated data will be provided when it is available.

Table 9. Electrical Engineer Salaries

Location	Engineer	Employment	2001 Mean Annual Salaries*
United States	Electrical Engineers	151,300	$68,630
	Electronics Engineers	123,210	$69,710
	Computer Hardware Engineer	67,590	$74,300
Washington State			
	Electrical Engineers	3,050	$71,327
	Electronics Engineers	3,100	$65,265
	Computer Hardware Engineer	1,340	$70,120
Seattle-Bellevue-Everett			
	Electrical Engineers	1,500	$72,651
	Electronics Engineers	2,130	$63,660
	Computer Hardware Engineer	970	$69,967
Spokane			
	Electrical Engineers	210	$59,428
	Computer Hardware Engineer	**	$87,301

*US Department of Labor Bureau of Labor Statistics Occupational Employment Statistics, www.bls.gov.
**No data available

5.3 Program Costs and Revenue.

For the proposed program identify the:

Facilities/Capital costs
As shown on Table 5, page 18, equipment replacement and maintenance costs are estimated to be $60,000 per year. Eastern Washington University is constructing a new campus facility. This facility will house the Department of Engineering Technology and Multimedia Design and was designed to also accommodate the Electrical Engineering program on the Cheney campus. The North Seattle Community College campus has digital/electronics laboratory stations available that will accommodate an estimated total enrollment of 96 students. This laboratory is currently not utilized in the afternoons. Multi-way interactive distance education classrooms using the K-20 network are available both on the NSCC and the Cheney campuses. These classrooms will be utilized for classes originating on the Cheney campus or the NSCC campus.

Non-recurring operating budget start-up costs by area of expense
Potential non-recurring operating budget start-up costs include the following: program marketing, $5,000; faculty recruiting, $8,000; initial program set-up travel, $2,000; and initial library expenses, $26,000.

VI. External Reviews

6.1 External Reviews

External reviews were prepared by the following people:

i) Dr. Larry Wear
Professor and Chair
Electrical and Computer Engineering Department
California State University, Chico

ii) Dr. Terri Fiez
Director and Professor
School of Electrical Engineering & Computer Science
Oregon State University

iii) Dr. Ping Hou
Staff Engineer
Fodus Communications, Inc.
PhD. Electrical Engineering, WSU

iv) Terry Decker
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Phone 509-921-4001
Fax 509-921-3991

v) Tuanhai Hoang, President
www.qualitelcorp.com
4608 150 AVE NE
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Phone 425-702-8889
Fax 425-702-8885

External reviews follow with discussion of these reviews in Section 6.2.

California State University, Chico
Chico, California 95929-0888
Department of Electrical and Computer Engineering
530-898-5343 Fax: 530-898-4956

Michael Brzoska, Ph.D.
Professor and Chair
Cheney Hall 101
Cheney, WA 99004

September 5, 2003

Dear Dr. Brzoska:

I have reviewed the proposal for the new degree in Electrical Engineering (EE) at Eastern Washington University. You have done a complete and thorough job of presenting the case for the new program. My evaluation of the proposal is separated into four parts: Program Need, Program Description, Assessment, and Finances.

Program Need

The proposed EE program seems to fit well with the University's role and mission. The proposal cites several studies that show the need for more electrical engineers in the state of Washington and that the institutions currently offering the EE degree are not capable of fulfilling the need. I think that some of the studies that support the need were conducted prior to the collapse of the dot-coms and perhaps the growth in the demand for EE should be reevaluated. (I realize that the Washington economy and job potential are different than California's, but in California we have seen a drastic drop in the demand for new electrical engineers. Fewer than 50% of the last two graduating classes of EE have had job offers in the engineering profession at the time of graduation. Also, a number of our recent graduates have been terminated from their positions in the past two years.) Part of the reason for the decline in demand for EE is that many of the traditional employers of our graduates are shifting development and support to offshore groups in Asia and Eastern Europe. You may want to evaluate the impact of this trend on the demand in Washington. Since Washington has a strong position in the power generation industry and that industry seems to be growing, it may be that there will be an increased demand for EE graduates with an option in power generation and distribution.

Program Description

The goals and objectives established for the EE program are consistent with what one would expect of a contemporary electrical engineering program. They are compatible with the outcomes ABET requires each engineering program to demonstrate.

Since ABET requires that all graduates from an accredited engineering program meet the outcomes ABET specifies in it's a) through k) criteria, it would be helpful if your program outcomes were mapped to the ABET outcomes. (During the last two years many programs are adopting the ABET a)-k) outcomes directly and not trying to rephrase or reword them. You might want to consider this for the future since it eliminates the need to map your outcomes to ABET's.) There seem to be words missing in the first two outcomes, but I believe I understand the intent.

In section 2.2.2 it seems to imply that students will not be admitted to the EE program until the junior year. Into what program will freshmen be admitted?

The description of how the program meets all seven ABET criteria is well done and complete. It is possible that some ABET evaluators would be concerned that the only engineering science included in the program is electrical engineering. However, I feel that you could make a good argument that your students will be able to meet the program's objectives without any other engineering courses. (Our program now requires only two engineering science courses outside of electrical engineering: statics/dynamics and thermodynamics for EEs.)

Linking the classrooms between Cheney and NSCC sounds like a good way to leverage the capability of a limited size faculty. However, I question how the laboratory assignments at NSCC will be monitored when the faculty is in Cheney. Is there a plan to provide adequate supervision in the laboratories? Lack of qualified faculty at NSCC could present a safety problem especially in the power lab. I wonder too how students at NSCC will receive advising if the full-time EE faculty is all located in Cheney. Also, you will need qualified faculty at the NSCC campus to direct students who are taking the capstone course. Perhaps one of the new faculty should be located at the NSCC campus.

The report recognizes the need for additional EE faculty with the terminal degree. Implementation of the degree should not proceed until at least one of the new EE faculty member has been hired.

The four-year program outlined on page 20 of the report looks fairly typical and is quite similar to the one we follow at Chico. I am a little surprised that you do not require any courses in DSP, Controls, or Communications. Since the description of the requirements for the new faculty included all of these areas, it seems like one or more should be required. My only criticism of the four-year plan is that the capstone course is only one quarter long. Many schools, including Chico, extend the capstone course over an entire year. At Chico we have found that dedicating the first semester to requirement and design and the second semester to implementation and testing works fairly well. You might want to think about splitting the 4-unit capstone class into two 2-unit classes. This would also balance out the unit load in the senior year.

I do have a question about the statistics classes, MATH 385 and 380. Do they cover applications in electrical engineering? ABET want you to include the application of probability and statistics to your specific engineering field. Perhaps your math class does this, or you cover applications in one of the required EE classes.

Assessment

Assessment is an important issue for all engineering departments. My faculty has been working on the issue for over two years and we are still worried that we will not meet the newest ABET guidelines. In a white paper published this summer ABET specifically states that several forms of assessment upon which many programs have been relying are not adequate. They specifically state the student self-assessment can not be used as a primary means of verifying that program outcomes have been met. The white paper also states that grades in a course by themselves do not provide an adequate assessment of the students' mastery of the program's outcomes. Since the assessment described in your proposal relies on these two forms of assessment, I do not believe it would meet ABET's requirements. (I am including a copy of the white paper on assessment for your review.)

It is my understanding programs must verify that graduating seniors have met the program's educational outcomes. The survey described in your assessment plan uses employers and recent graduates. I think you will need a more direct assessment of the outcomes at the time the students graduate to satisfy ABET. (I don't claim to be the ultimate expert on assessment, but I am an ABET program evaluator for electrical and computer engineering.)

Finances

I was confused by the statement that, "No new state funds are being requested to implement the Electrical Engineering program." After looking more closely at Table 4., I assume that is because money is being taken away from some other program at EWU and **the total support from the state for EWU will remain unchanged. I commend you on** getting a commitment for $60,000 per year for equipment replacement and maintenance. This is extremely important for a high technology program like electrical engineering. Having a line item in the budget for this will give your program a real advantage over programs like mine that have to rely on donations and grants to fund replacement and maintenance.

Based on my experience I question whether a 1/2-time department secretary is adequate. Speaking from personal experience, one full-time secretary is barely enough for a department with 7 faculty and 300 students. Since your department will not be that large in the beginning, you can probably get by with less secretarial help than we have.

Summary

The key areas for a new degree proposal have been fully addressed by the electrical engineering proposal. Since assessment is an ongoing issue for many engineering programs, it is not surprising that there is room for improvement in this area. My other area of concern is how faculty will be able to adequately supervise, monitor, and advise student at a remote campus. I believe that changes in these two areas will result in a superior proposal.

If you have any questions regarding my comments and observations, I would be happy to discuss them with you.

Respectfully,

Larry L. Wear, Ph.D.
Professor and Chair
Electrical and Computer Engineering Department
California State University, Chico

SCHOOL OF ELECTRICAL
ENGINEERING AND
COMPUTER SCIENCE

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October 23, 2003

Esteban Rodriguez-Marek
Department of Engineering Technology and Multimedia Design
Eastern Washington University
Cheney, WA 99004

Dear Dr. Rodriguez-Marek,

Thank you for selecting me to review you proposed Bachelor and Science degree in Electrical Engineering. I am very familiar with EWU as I grew up in Cheney. From 1990-1999, I was on the faculty of the School of Electrical Engineering and Computer Science at Washington State University in Pullman. Since leaving WSU four years ago, I have been department head of Electrical & Computer Engineering and, more recently, Director of the School of Electrical Engineering & Computer Science at Oregon State University. I have read the new degree proposal carefully and I support many aspects of the proposal. As requested, my comments will be targeted toward whether the curriculum 1) meets the needs of higher education in the State of Washington, 2) avoids duplication with other programs in the state and region and 3)is expected to provide a quality education to students wishing to pursue a career in Electrical Engineering.

Does this curriculum meet the needs of higher education in the State of Washington?

From the data presented, it appears there is a market for students who would like to get Electrical Engineering degrees in the Seattle area but are not currently served. This market would be derived from students that do not currently get accepted into the Electrical Engineering Department at University of Washington as well as students that are currently working in the area. While data is presented from the AEA that there is a large need for these degrees also in the Spokane area, there have been attempts by other institutions to address this need. In the end, WSU found that the student numbers in Computer Engineering were not there to support the program. From this past experience, one would expect that the student numbers would be low in the Spokane area.

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Does this program avoid duplication with other professional education programs in the state and region?

This program does in fact duplicate other professional programs in the Seattle area (UW). However, University of Washington does not have the capacity and so this proposed program serves a need in that community. Currently, there is not an Electrical Engineering program in the Spokane area other than Gonzaga's - which is private. Washington State University is located very close to Spokane/Cheney but this will not address place bound students. The proposed program will provide local access for working professionals and the courses will be offered at times that accommodate these students.

Does this proposal provide a quality professional education in Electrical Engineering?

The curriculum outlined is very standard for an Electrical Engineering program. It will provide students with both the depth and breadth needed to become practicing Electrical Engineering professionals.

The labs both at North Seattle and in Cheney appear to be well equipped with state of the art instrumentation. As the student numbers increase, more fully equipped laboratory stations will be needed and new advanced equipment will be required.

My one concern with this proposal is if the necessary resources will be available to provide a high quality education. The proposal outlines that courses in North Seattle will be taught remotely. I have experience teaching students in multiple locations through the WHETs system (in Washington) as well as a system of delivery we have in Oregon. While the technology is improving all the time, I believe it is difficult to provide a truly high quality undergraduate education through electronic transmission. The primary problem is that it is difficult to have the two-way interaction needed to really help students succeed. There may be ways to overcome this if on-site instructors are appointed to provide help sessions and office hours.

The other area that potentially compromises the quality of the program is delivering too many classes with adjunct faculty. I know from my own experience that there are excellent people that can be hired for this role – and I have done this at Oregon State University. However, it is imperative that there be a critical mass of faculty resident at the site to give continuity and ensure the quality of the program. This will also be important if accreditation is sought. For the ABET accreditation, there must be a critical mass of faculty affiliated with the program. I believe that number is at least five faculty.

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A third area that helps to ensure a quality program is faculty that are actively practicing their professions either through outside employment or research. The proposal stated that this program is much less expensive to deliver because faculty will not be engaged in research or at least not to a high degree. I would encourage the administration to balance the teaching activities with research activities to help keep the faculty abreast of new developments in the field. This is very important in areas such as Electrical Engineering since the field is changing so rapidly. One example of these developments are the handheld computers of today are far superior to the desktop computers of less than 10 years ago.

Overall, I believe the proposal outlines a viable Electrical Engineering program. With the appropriate resources, it has the potential of becoming a high quality program that will complement many of Washington's already first-rate education opportunities. Please don't hesitate to contact me if there are any further questions. I would be happy to discuss this further if needed.

Sincerely,

Terri Fiez

Terri Fiez
Director and Professor
School of Electrical Engineering & Computer Science
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Fodus Communications, Inc
Connecting Anywhere Anytime

Michael Brzoska, Ph.D.
Professor and Chair
Cheney Hall 101
Cheney, WA 99004

October15, 2003

Dear Dr. Brzoska:

I have reviewed the proposal for establishing a new Electrical Engineering (EE) program at Eastern Washington University (EWU). I am in favor of the effort to have a new EE program at EWU because this will meet the statewide and nation-wide demands for hi-tech engineers and the current proposal is realizable.

Let me summarize my own current scientific and industry standings. I received my Ph.D. in 2002 and M.S. in 1997 (both in EE) from Washington State University (WSU). My doctoral research is focused on wireless communication, especially channel capacity and modulation over fading channels, and vector quantization for source coding. My master research is concentrated on system and control theory, particularly, saturation problems for continuous- and discrete-time linear systems. I have published five journal papers on *IEEE Trans. On Communications* and *IEEE Trans. On Automatic Control* etc., and some conference papers. When I was a student at WSU, I served as a reviewer for several journal and conferences in my field. Between July 2001 and Dec. 2002, I was with Advanced Micro Devices, where my main responsibility is to design and develop IEEE 802.11A-standard wireless communication product. Currently, I am with Fodus Communications, Inc. at Sunnyvale, CA, where I am responsible for designing and developing IEEE 802.11 B/G/A-standard wireless network products.

My comments on the proposal will be concentrated on the curriculum part.

As U.S.A is on the cutting edge of the information and technology economy, more attention should be paid to educate the U.S. workforce. This is the only way to keep U.S. as the leader of hi-tech industry in the world. Therefore, the new program should train students and make them well prepared for their careers.

The proposal has provided a good series of traditional EE courses at the first two years for undergraduate study, which lays a good foundation for students to pursue further study. Meanwhile, proposed labs and equipment are excellent since most of commonly used equipment in industry, for instance, logic analyzer, signal generator, spectrum analyzer, microprocessor testboard and software tools such as Matlab, are covered.

Current industry demands students with broad background in EE both in terms of using fundamental theory and equipment/tools. Only when students meet these demands can they have good capability to face challenges. The proposal notices these demands.

Personally, I think there should be more elective courses in junior and senior years for intensive and extensive studies. I understand that EWU needs to hire new professors for these courses. As a senior engineer with experience of working at both big and start-up companies at Silicon Valley, my suggestion is to improve the Tentative 4-yr Plan (at page 20) by adding more elective courses and corresponding labs. Simply putting, courses on digital signal processing (dsp), control theory, analog circuit, image processing, wireless communication, analog and digital communications, should be offered. Schedules for elective course have to be changed accordingly. The following suggestions are under assumption that some new faculty will join EWU before the courses are offered.

1. A probability and statistics courses, "Engineering Probability and Statistics", should be offered at fall or winter quarter in junior year. This course is different from a pure Mathematics course. The topics in this course should cover those concepts commonly used in communication and dsp, for example, correlation, spectrum, Gaussian distribution, hypothesis testing and filtering. The goal for this course is to allow students directly touch topics in dsp and communication when they take related EE courses later.

2. Since "Signals and Systems I" does not need any pre-requite EE courses, I suggest that this course should be moved to fall quarter and "Signals and Systems II" offered at the next quarter. In this way, at the spring quarter of junior year, students can choose their first dsp, and/or control theory and/or communication course(s). Otherwise, students will find it difficult to cope with the subsequent elective courses because of timing.

3. Today, communication applications can be found in optical/wireless/satellite communications, IC design and storage system. Thus, strengthening communication courses is crucial. A three-quarter communications course series can be considered: analog communication for the first quarter, digital communication for the next two quarters. The topics for digital communication might cover fundamentals of coding theory (block code and convolutional code), various modulation schemes and their application for telecom channel, equalization, detection and system performance evaluation. The objective is that, after three-quarter study, a student can work with experienced communication engineers with solid communication theory and skills.

4. As digital circuit is in extensive use, dsp techniques are applied almost everywhere. Therefore a two-quarter dsp course series, "DSP I" and "DSP II", are recommended when students already finish "Signals and Systems II". "DSP I" can discuss A/D and D/A converters, quantization noise, filter structure and baseband filter design. "DSP II" will address adaptive filter design, transform algorithm such as DCT, FFT and their applications. It should be noted that "DSP I" can help students understand analog circuit design better. Some application examples used in industry might be provided in "DSP II", for instance, JPEG standard and/or IEEE 802.11 standard.

5. To make the EE program span more extensively, many elective courses and the related labs on digital circuit design, analog circuit design, wireless communication, and control, should be added. For instance, "Linear Control Theory I" can consist of classical control theory and "Linear Control Theory II" will address modern control theory. The basic concept of feedback can be thoroughly discussed in these two courses so that students can reduce difficulties in learning dsp, analog circuit and even RF circuit. If possible, Verilog and/or VHDL design tool(s) might be introduced in digital circuit course since they are used in practical design. In general, courses in the last two quarters are elective and at that time students should spend a large amount of time on their design project or research project with their advisors. Courses, which can find wide application in industry, are recommended for the last two quarters.

Below is my suggested tentative 2-yr plan. Due to the recession in hi-tech industry, I think that finding qualified faculty with industry connection and experience is not much difficult. However, to enhance labs might be subject to budget. Note that offering these courses is contingent on instructors, student registration and labs/tool preparation.

Tentative Junior and Senior Plan

Fall		**Winter**		**Spring**	
Junior					
Digital Circuits I	4	Digital Circuits II	4	Microprocessor I	4
Electronics I	5	Electronics II	5	Energy System	5
Signal and System I	5	Signal and System II	5	Analog Communication	4
Engineering Probability and Statistics	4	General Chemistry	5	Fundamentals of Devices and Materials	4
Physics IV and Lab	5			Linear Control Theory I	4
Senior					
Linear Control II	4	Analog Circuit Design	5	Wireless Communication	4
Digital Communication I	4	Digital Communication II	4	Image Processing	4
DSP I	4	DSP II	4	VLSI Circuit Design	5
Technical Writing	5	Digital Circuit Design	4	Capstone	5

I do believe that EWU has capability to establish its EE program since it already has solid foundation. The only thing remained to do is to find some appropriate and qualified faculty who can provide some of the elective courses and extend labs. If this can be done, the proposal will be surely a superior one.

Best regards,

Ping Hou

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Agilent Technologies

October 30, 2003

Esteban Rodriguez-Marek
Assistant Professor
Department of Engineering Technology and Multimedia Design
Eastern Washington University
Cheney Hall 101
Cheney, WA 99004

Dear Esteban,

Thank you for the opportunity to review the EWU EE program proposal.

In general, it looks good. I have just a couple of comments for your consideration:

With regard to the growth in electrical engineering job opportunities, we are anticipating a continued slow economy and there are many experienced, qualified EE's seeking employment in a tight market. I am concerned that the statistics that have been cited may be overstating the near term opportunity for EE's. Will there be a delay in getting to these numbers? This may not be germane to the proposal, but I do not see as optimistic an EE job market as is portrayed in the proposal, at least in the near term.

With regard to curriculum, the core curriculum looks solid. Areas of focus listed are Signal Process and/or Communication Systems, VLSI Design and Analog Integrated Circuit Design, and Power Systems and Controls. These are all great focus areas, my concern is that students will get a good breadth of knowledge, but may not get the depth, specialization that could come with a more focused curriculum approach. This may make it more difficult for students to focus, develop a passion and expertise around a specific field of study.

I am excited to see the proposal advancing; it is great for the area and good for Agilent to have this program available locally at Eastern.

Best regards,
Terry Decker
Product Marketing Manager
Agilent Technologies

td/rb

Subject: RE: EWU EE draft proposal
Date: Fri, 31 Oct 2003 16:20:04 -0800
From: Tuanhai Hoang <tuanhai.hoang@qualitelcorp.com>
To: Michael Brzoska <michael.brzoska@mail.ewu.edu>

Mick,

I review your proposal and its look fine from my observation. I would like to see a clearer direction for the student assessment as you continue to define the program. For the program to be successful we need to make sure that we get students that are prepared and can succeed in the EE program.

Tuanhai

Tuanhai Hoang, President
www.qualitelcorp.com
4608 150 AVE NE
Redmond, WA 98052
425-702-8889 Fax 425-702-8885

NOTE: The information contained in this electronic message may be privileged and confidential information intended only for the use of the individuals or entity named above. If you have received this communication in error, please notify us immediately and delete any and all copies of the electronic message. Thank you.

-----Original Message-----
From: Michael Brzoska [mailto:michael.brzoska@mail.ewu.edu]
Sent: Monday, October 20, 2003 11:17 AM
To: tuanhai.hoang@qualitelcorp.com
Subject: EWU EE draft proposal

Tuanhai Hoang,
For your review, I have attached Eastern Washington University's draft proposal to the Higher Education Coordinating Board to offer a BS in Electrical Engineering at the North Seattle Community College campus in 2004 and at the Cheney campus in 2006. You response may be placed in a letter or email sent to me. (Mick Brzoska, CHN 101, Eastern Washington University, Cheney, WA 99004) Thank you for agreeing to undertake this review. Mick

6.2 Responses to External Reviews

6.2.1 Dr. Larry Wear

Dr. Larry L. Wear's review was separated into four parts. Each part will be addressed independently.

i) Program Need
While it is true that many companies are shifting development and support to overseas branches, data provided by the Washington State Bureau of Statistics shows that there will be a lack of Electrical Engineers in the State of Washington. The data shown in the proposal is current and is updated yearly by the Bureau. Thus, the need for Electrical Engineers in the State of Washington, as shown in Section 1 and Section 5.2, page 19, and Tables 7 and 8, pages 19 and 20 respectively, is real and will become a problem if not properly addressed by Universities in the State.

ii) Description
This section contains the bulk of the reviewer's comments.

- It is suggested that the program outcomes should be mapped directly to ABET (Accreditation Board for Engineering and Technology) outcomes. ABET is the organization that provides accreditation to all Engineering and Engineering Technology programs. The outcomes of the new Electrical Engineering program have now been mapped to ABET outcomes and are shown in tabular form in Section 3.2, page 16.
- Students will be admitted into the program after they have completed the courses indicated in section 2.2.2, page 11. This is done so that some degree of selectivity is forced upon admission to the program. Prior to that, students will be pre-engineering Eastern Washington University students.
- Thorough research has been done about the curriculum in various universities in the State of Washington and in the rest of the country. While some universities do require one more engineering science than our curriculum shows, most of them do not require it. Our curriculum already requires five quarters of Physics, one quarter of Chemistry, and several Electrical Engineering courses. Any Electrical Engineering curriculum is required to have many core classes, since such a great variety of fields are available in the discipline (e.g. Communication Systems, Microprocessors, Digital Signal Processing, Control Systems, Power Systems, etc.). In order not to overcrowd the curriculum and leave space for engineering electives, it was decided not to include the extra engineering science class. Further, ABET does not require this class.
- Section 2.3, page 12, in the proposal has been modified to make it clear that at least one faculty member will be working full time at NSCC. This faculty will be in charge of monitoring laboratories and advising students based at NSCC. Note that more than one full-time professor may be assigned to the NSCC campus.
- Electives in the curriculum will require at least a sequence of two courses to be chosen by the student. These sequences are in the fields of Communications, Digital Signal Processing, Control, and Microelectronic Devices.
- The reviewer suggests that the capstone class be made a two quarter sequence. The capstone class was designed to meet university requirements as a one quarter, four credit class. If the size of the project requires, one further quarter of variable credits can be included as an independent study. The decision to do this will be left to the professor in charge of the capstone class.
- The reviewer is concerned about the statistics and probability class (Math 380 or Math 385) including specific applications in electrical engineering. This comment comes along the lines of ABET accreditation, which requires specifically that the student is presented with statistical applications in engineering. While the classes listed above do not have direct applications in electrical engineering, several classes in the curriculum fulfill this requirement (Signals and Systems I and II, Communication Systems, Control Systems, Electromagnetism, etc.).

iii) Assessment
It is noted that according to ABET, student self assessment or grades in a specific class cannot be used alone as a method for evaluating program outcomes. While we do base our evaluation on class grades and on employer and employee surveys, we never use each one independently. That is, triangulation is always used to ensure that a legitimate evaluation is obtained. Furthermore, whenever possible, students' projects

and presentations are used for assessment. The triangulation provided is expected to meet ABET's assessment requirements.

iv) Finances
No concerns were presented in this section.

6.2.2 Dr. Terri Fiez

The reviewer's response was partitioned into three clear items. Each one will be addressed separately.

i) Program Need
The reviewer is concerned about student interest in the Spokane area. Since the program will be offered at both the Seattle and Cheney campuses, enrollment at the Seattle campus will compensate for lower enrollment in the Cheney area (See Tables 1 and 3, pages 8 and 14 respectively).

ii) Program Duplication
No concerns were presented in this section.

iii) Program Quality
The bulk of the reviewer's comments were presented here.

- Lack of faculty at NSCC branch. The proposal has been modified to emphasize that at least one faculty will work full time at the NSCC branch. His/her duties will include advising, office hours, and lab monitoring. More than one faculty member may eventually be assigned to the NSCC campus.
- Excessive classes assigned to adjunct faculty. The proposal has been written under the assumption that all classes will be taught by full time EWU faculty either from NSCC or from the main campus. Adjunct faculty may be used if an elective class is proposed which is outside the expertise of EWU affiliated faculty.
- Balance needed between research and teaching activities. A primarily teaching university differs from its research counterpart in the partition of the teaching and research loads. While in a research institution teaching and research commitments are fairly equally balanced, in a teaching institution the class load is substantially higher. However, it remains a requirement for promotion, tenure, and retention that faculty members fulfill a number of peer-reviewed scholarly activities. Thus, each professor is expected to keep up to date with his/her field. Further professional activities include consulting, grant preparation, and contract administration.

6.2.3 Dr. Ping Hou

The reviewer did a thorough job analyzing the proposed curriculum, including several suggestions to improve it. The main concern presented in this review is the apparent lack of Electrical Engineering elective credits in the curriculum. The curriculum, described in Section 2.2, page 10, has now been revised to include 15 elective credits. Furthermore, three set areas of coherence have been devised. These areas of coherence include most of the elective sequences that the reviewer suggests. A curriculum must be designed so that no more than 18 credits per quarter are expected from the student, as higher credit loads may be counter-productive. This does not allow us to adopt the suggested course of studies detailed in the review. However, the elective credits that have been added make the curriculum a much stronger one.

6.2.4 Terry Decker

The reviewer is mainly concerned with the placement of future graduates. As shown in Section 1, page 4 and Section 5.2, page 19 and Tables 7 and 8, pages 19 and 20 respectively, the demand for Electrical Engineers in the State of Washington will outgrow the supply from Universities in the State.

The last concern of the reviewer is with the depth of the program. Section 2.2.1, page 10 in the proposal has now been modified to show three main areas of specialization. This modification was complemented by increasing the number of technical electives in the curriculum.

6.2.5 Dr. Tuanhai Hoang

No concerns are raised by this reviewer.

Appendices

Appendix I
Proposed Program for a Bachelor of Science in Electrical Engineering
Electrical Engineering Course Syllabi

Appendix II
Proposed Program for a Bachelor of Science in Electrical Engineering
Seattle Community Colleges Transfer 4 year Program

Appendix III
Proposed Program for a Bachelor of Science in Electrical Engineering
Spokane Falls Community College Transfer 4 year Program

Appendix IV
EWU Electrical Engineering Laboratory Equipment

Appendix V
NSCC Laboratory Equipment

Appendix VI
Resumes
Dr. Min-Sung Koh
Professor William Loendorf (Pre-engineering)
Professor Esteban Rodriguez-Marek (Pre-engineering)
Michael A. Brzoska Department Chair

Appendix I: Proposed Program for a Bachelor of Science in Electrical Engineering Course Syllabi

Tentative 4-yr plan

	Fall		Winter		Spring		By subject	
	Freshman						Prog Prin	6
	Calculus I (MATH 161)	5	Calculus II (MATH 162)	5	Calculus III (MATH 163)	5	Math	15
	GECR	5	GECR	5	Physics I (PHYS 151)	4	Phys	5
	College Composition (ENGL 201)	5	Programming Prin. I (CSCD 225)	5	Physics I Lab (PHYS 161)	1	GECR	15
			Programming Prin. I Lab (CSCD205)	1	GECR	5	Engl	5
46	Total	15	Total	16	Total	15		
	Sophomore						ENGR	9
	Programming Principles II (CSCD 226)	5	*Circuits II (ENGR 210)*	5	GECR	5	Prog Prin	5
	GECR	5	Physics II (PHYS 152)	4	Physics III (PHYS 153)	4	Math	14
	Differential Equations (MATH 347)	4	Physics II Lab (PHYS 162)	1	Physics III Lab (PHYS 163)	1	Phys	15
	Circuits I (ENGR 209)	4	Linear Algebra (MATH 231)	5	Calculus IV (MATH 241)	5	GECR	10
48	Total	18	Total	15	Total	15		
	Junior							
	Digital Circuits I (ENGR 160)	4	*Signals and Systems I (ENGR 320)*	5	GECR	5	GECR	5
	Electronics I (ENGR 330)	5	*Electronics II (ENGR 331)*	5	*Signals and Systems II (ENGR 321)*	5	Engr	30
	Physics IV (PHYS 221)	4	General Chemistry (CHEM 151)	5	*Microprocessors I (ENGR 260)*	4	Chem	5
	Physics IV Lab (PHYS 164)	1	Digital Circuits II (ENGR250)	2			Phys	5
45	Total	14	Total	17	Total	14		
	Senior						Math	5
	Prob. and Intro. to Statistics (MATH 385) (4 cr)		*EE Elective*	5	*EE Elective*	10	Engl	5
	or Elem. Prob. and Statistics (MATH 380)	5	*Energy Systems (ENGR 350)*	5	Tech. and World Civil.(TECH393)I.S.	4	Engr	9
	Technical Writing (ENGL 205)	5	Cultural/Gender Diversity	4	*Capstone (ENGR 490)*	4	Capstone	4
	Electromagnetism (PHYS 401)	4					Cult Div	4
46	Total	14	Total	14	Total	18	EE Elec	15
185							Tech393	4

New courses are shown in Italics.

Mathematics	34	Sciences	25	Programming Proficiency	11
Core Courses	48	EE Electives	15	GECR	30
Written and Oral Communications	10	Cult. Div.	4	Tech 393 International Studies Req.	4
Capstone	4	TOTAL 185			

Spring 2003

ENGR 160 – DIGITAL CIRCUITS

Section 1

Department of Engineering Technology and Multimedia Design at Eastern Washington University

OBJECTIVE: Digital Design is concerned with the design of digital electronic circuits. Digital circuits are employed in the design of many systems such as computers, control systems, data communications, and many others. The course presents the basic tools for the design of digital circuits and provides methods and procedures for a variety of digital design applications.

COURSE OBJECTIVES: By the end of this class you should be able to:

- Convert any number between different number systems.
- Perform arithmetic operations on binary, octal, and hexadecimal numbers.
- Identify when radix and diminished radix complements are to be used.
- Describe the operation of each one of the logic gates.
- Prove and apply all theorems of Boolean algebra.
- Perform gate level minimization algebraically and with advanced methods.
- Describe each one of the combinational logic devices.
- Design and optimize complex combinational logic circuits.
- Derive latches and flip-flops.
- Design simple synchronous sequential logic circuits.

INSTRUCTOR: First Last-Name
E-mail: First.Last-name@ewu.edu
Office: Cheney Hall XXX
Phone: (509) 359-YYYY

PREREQUISITES: MATH 104 or equivalent.

OFFICE HOURS: Monday -- Thursday: 10:30 AM – 11:30 AM
I encourage you to make appointments if these times conflict with your schedule.

REFERENCE TEXT: *Digital Design*, Third Edition by M. Morris Mano. Prentice Hall, 2002.

LECTURES: Tuesday, Thursday: 1:00 PM – 2:45 PM
Cheney Hall 208

WEB SITE: The website for this course is:
http://www.technology.ewu.edu/Engr160/
Please check it periodically, as all the assigned homework, together with the homework solutions, handouts, etc will be posted there. You will be responsible for any material posted. Note that the last slash is needed!

GRADING:

Assignments:	35%	Due during class on the due date.
Quizzes:	30%	No make up quizzes. Lowest grade will be dropped.
Final Exam:	35%	Comprehensive.

There will be **no** curve. Please note that the assignments supply a considerable chunk of your final grade. While I do this to help you out, missing assignments will significantly hurt your final grade.

4.0↔100	3.5↔90	3.0↔80	2.0↔70	1.0↔60

4.0↔99	3.4↔89	2.9↔79	1.9↔69	0.9↔59
4.0↔98	3.4↔88	2.8↔78	1.8↔68	0.9↔58
4.0↔97	3.3↔87	2.7↔77	1.7↔67	0.8↔57
4.0↔96	3.3↔86	2.6↔76	1.6↔66	0.8↔56
4.0↔95	3.2↔85	2.5↔75	1.5↔65	0.7↔55
3.9↔94	3.2↔84	2.4↔74	1.4↔64	0↔54-0
3.8↔93	3.1↔83	2.3↔73	1.3↔63	
3.7↔92	3.1↔82	2.2↔72	1.2↔62	
3.6↔91	3.0↔81	2.1↔71	1.1↔61	

QUIZZES: Quizzes will be held weekly. Generally they will be multiple-choice type questions covering the material of the previous week. There will be NO make-up quizzes, as I will drop the lowest quiz grade.

HOMEWORK: Working in groups is encouraged. Groups up to 5 people may turn in ONE (1) homework with the names of all group members. Homework will be assigned each week and will be due the following week at the beginning of class. Assignments are to be done neatly in pencil, with all pages stapled together. Sloppiness will not be tolerated. Late homework will **absolutely NOT** be accepted. Solutions will usually be posted in the web the day after homework is due.

FINAL EXAM: Final examination will be held Monday, June 9, from 1:00 PM – 3:00 PM in Cheney Hall 208. It will be comprehensive. No make up on ANY circumstance.

ACADEMIC DISHONESTY: **Violations of academic dishonesty will be sanctioned.** Violations of academic integrity involve the use of any method or technique enabling a student to misrepresent the quality and integrity of his or her own academic work or the work of a fellow student. Students committing academic dishonesty will be reported to the appropriate university official and an XF grade for this course will be recorded on the student's transcript. In cases where a student has an existing record of academic dishonesty, a more severe penalty, e.g. involving suspension or dismissal from the university, may be sought.

HOLIDAYS: Holiday Day: MTWRF, Month ZZ.

TENTATIVE OUTLINE: **Chapter 1: Binary Systems**

1.1 Digital Systems
1.2 Binary Numbers
1.3 Number Base Conversions
1.4 Octal and Hexadecimal Numbers
1.5 Complements
1.6 Signed Binary Numbers
1.7 Binary Codes
1.8 Binary Logic

Chapter 2: Boolean Algebra and Logic Gates

2.1 Basic Definitions
2.2 Axiomatic Definition of Boolean Algebra
2.3 Basic Theorems and Properties of Boolean Algebra
2.4 Boolean Functions
2.5 Canonical and Standard Forms
2.6 Digital Logic Gates

Chapter 3: Gate-Level Minimization

3.1 The Map Method
3.2 Four-Variable Map

3.3 Five-Variable Map
3.4 Product and Sums Simplification
3.5 Don't Care Conditions
3.6 NAND and NOR Implementation

Chapter 4: Combinational Logic
4.1 Combinational Circuits
4.2 Analysis Procedure
4.3 Design Procedure
4.4 Binary Adder-Subtractor
4.5 Decoders
4.6 Encoders
4.7 Multiplexers

Chapter 5: Synchronous Sequential Logic
5.1 Sequential Circuits
5.2 Latches
5.3 Flip-Flops
5.4 Analysis of Clocked Sequential Circuits
5.5 State /reduction and Assignment
5.6 Design Procedure

NOTE: Eastern Washington University strives to make academic accommodations for students with identified special needs. Students with disabilities are encouraged to make an appointment or see me during my listed office hours.

Fall 2002

ENGR 209 – CIRCUIT THEORY

Department of Engineering Technology and Multimedia Design at Eastern Washington University

DESCRIPTION: This course is intended to provide you with a basic understanding of electricity and its applications. In this course, basic concepts of current, voltage, and resistance will be provided. In addition, basic circuit-analysis methods including inductor and capacitor will be explained.

COURSE OBJECTIVES: By the end of this class you should be able to:

- Describe current, voltage, and resistance.
- Explain the concepts of Power and Energy.
- Evaluate circuits using Ohm's law and network theorems.
- Solve series and parallel circuits (DC).
- Describe Capacitors and Inductors.
- Explain magnetic circuits.
- Apply Phasor concepts.
- Derive basic AC circuit analysis.
- Solve series and parallel circuits including capacitor, inductor (AC).

INSTRUCTOR:
Min-sung Koh
E-mail: mkoh@ewu.edu
Office: Cheney Hall 103
Phone: (509)359-4342

PREREQUISITES: MATH 163 (Calculus III).

OFFICE HOURS: Monday -- Friday: 4:00 PM – 5:00 PM
I encourage you to make appointments if these times conflict with your schedule.

REFERENCE TEXT: *Introductory Circuit Analysis,* Tenth Edition by Boylestad.

LECTURES: Monday, Tuesday, and Thursday: 8:00 AM – 8:50 AM
Cheney Hall 205

LABS: Labs will be held in Science Hall 169.
Friday: 8:00 AM – 10:00 AM

WEB SITE: The website for this course is:
http://www.technology.ewu.edu/ENGR209/
Please check it periodically, as all the assigned homework, together with the homework solutions, handouts, etc will be posted there.

GRADING:

Assignments:	10%	Due at the beginning of class.
Labs:	20%	Report is due at the beginning of the next lab period.
Tests (3):	40%	No make up tests.
Final Exam:	30%	Comprehensive.

4.0↔100	3.5↔90	3.0↔80	2.0↔70	1.0↔60
4.0↔99	3.4↔89	2.9↔79	1.9↔69	0.9↔59
4.0↔98	3.4↔88	2.8↔78	1.8↔68	0.9↔58
4.0↔97	3.3↔87	2.7↔77	1.7↔67	0.8↔57
4.0↔96	3.3↔86	2.6↔76	1.6↔66	0.8↔56

4.0↔95	3.2↔85	2.5↔75	1.5↔65	0.7↔55
3.9↔94	3.2↔84	2.4↔74	1.4↔64	0↔54-0
3.8↔93	3.1↔83	2.3↔73	1.3↔63	
3.7↔92	3.1↔82	2.2↔72	1.2↔62	
3.6↔91	3.0↔81	2.1↔71	1.1↔61	

There will be no curve.

HOMEWORK: Working in groups is encouraged. Groups up to 5 people may turn in ONE (1) homework with the names of all group members. Homework will be assigned each week and will be due the following week at the beginning of class. Assignments are to be done neatly in pencil, with all pages stapled together. Sloppiness will not be tolerated. Late homework will be penalized with 20% of the grade for each day it is late. Homework will NOT be collected after solutions have been made available.

LAB REPORTS: One lab report per group is to be turned in. Reports are due at the beginning of the lab period following the completion of the experiment. Reports must follow the guidelines specified in the Lab Guidelines handout.

TESTS: There will be three (3) midterm examinations. There will be no make-up tests.

FINAL EXAM: Final examination will be held on Monday, December 9, from 8:00 AM – 10:00 AM in Cheney Hall 205. It will be comprehensive. No make up on ANY circumstance.

CHEATING: Cheating on a midterm or final examination will result in failing the course. No exceptions.

TENTATIVE OUTLINE:
Chapter 1: Introduction
Chapter 2: Current and Voltage
Chapter 3: Resistance
Chapter 4: Ohm's law, Power, and Energy
Chapter 5: Series Circuits
Chapter 6: Parallel Circuits
Chapter 7: Series-Parallel Networks
Chapter 8: Methods of Analysis and Selected Topics (dc)
Chapter 9: Network Theorems
Chapter 10: Capacitors
Chapter 11: Magnetic Circuits
Chapter 12: Inductors
Chapter 13: Sinusoidal Alternating Waveforms
Chapter 14: The Basic Elements and Phasors
Chapter 15: Series and Parallel ac Circuits
Chapter 19: Power (AC)

NOTE: Eastern Washington University strives to make academic accommodations for students with identified special needs. Students with disabilities are encouraged to make an appointment or see me during my listed office hours.

Spring 2003

ENGR 210 – CIRCUITS II

Department of Engineering Technology at Eastern Washington University

DESCRIPTION: Circuits II investigates the small signal analysis, dc operating point, first-order circuits, second-order circuits, SPICE and circuit simulation methods, sinusoidal steady state, phasors, poles and zeros of network functions, ideal transformed linear and non-linear two-port networks.

COURSE OBJECTIVES: By the end of this class you should be able to:

- Design linear circuits excited with sinusoidal sources.
- Design circuits containing nonlinear elements.
- Determine the transient analysis of second order circuits with unit step inputs and switched dc sources.
- Evaluate time-domain linear circuit response.
- Derive Laplace transforms for simple functions.
- Formulate and obtain transient solutions to system differential equations using Laplace techniques.
- Obtain the Fourier transform of a finite-energy signal, and the inverse-Fourier transform of a spectrum.
- Apply phasor and frequency domain analysis techniques to determine steady state response.
- Evaluate complex power calculations.
- Analyze two-port circuits and characterize them using the common sets of two-port parameters.
- Apply the concepts of coupled inductors and transformers using the general two-port concept.

INSTRUCTOR: First Last-Name
E-mail: First.Last-name@ewu.edu
Office: Cheney Hall XXX
Phone: (509) 359-YYYY

PREREQUISITES: MATH 163 (Calculus III) and ENGR 209 (Circuits I)

OFFICE HOURS: Monday -- Friday: 10:30 AM – 11:30 AM
I encourage you to make appointments if these times conflict with your schedule.

REFERENCE TEXT: ***Electronic Circuits*** by James W. Nilsson & Susan A. Riedel. Prentice Hall, 2001.

LECTURES: Monday, Tuesday, and Wednesday: 9:00 AM – 10:00 PM, Cheney Hall 107.

LABORATORIES: Thursday: 8:00 AM – 10:00 AM, Science Hall 171.

WEB SITE: The website for this course is:
http://www.technology.ewu.edu/Engr210/
Please check it periodically, as all the assigned homework, together with the homework solutions, handouts, etc. will be posted there. Note that the last slash is needed!

QUIZZES: Quizzes will be held weekly. There will be NO make-up quizzes, as I will drop the lowest quiz grade.

HOMEWORK: Working in groups is encouraged. Homework will be assigned each Monday and will be due exactly one week after, at the beginning of class. If Monday is a holiday, homework will be assigned Tuesday. Assignments are to be done neatly in pencil, with all pages stapled together. Sloppiness will not be tolerated.

FINAL EXAM: The Final Examination for this course will be comprehensive. No make up Final Exam will be given under ANY circumstances.

GRADING:

Assignments:	10%	Due during class on the due date.
Lab Reports:	30%	Due at the beginning of the next lab period.
Quizzes:	30%	No make up quizzes.
Final Exam:	30%	Comprehensive.

4.0↔100	3.5↔90	3.0↔80	2.0↔70	1.0↔60
4.0↔99	3.4↔89	2.9↔79	1.9↔69	0.9↔59
4.0↔98	3.4↔88	2.8↔78	1.8↔68	0.9↔58
4.0↔97	3.3↔87	2.7↔77	1.7↔67	0.8↔57
4.0↔96	3.3↔86	2.6↔76	1.6↔66	0.8↔56
4.0↔95	3.2↔85	2.5↔75	1.5↔65	0.7↔55
3.9↔94	3.2↔84	2.4↔74	1.4↔64	0↔54-0
3.8↔93	3.1↔83	2.3↔73	1.3↔63	
3.7↔92	3.1↔82	2.2↔72	1.2↔62	
3.6↔91	3.0↔81	2.1↔71	1.1↔61	

CHEATING: Cheating on a midterm or final examination will result in failing the course. No exceptions.

HOLIDAYS: Holiday Day: MTWRF, Month ZZ.

TENTATIVE OUTLINE:

Sinusoidal Steady State Analysis
1. The Sinusoidal Source
2. The Sinusoidal Response

Sinusoidal Steady State Power Analysis
1. Instantaneous Power
2. Average and Reactive Power
3. Complex Power

Balanced Three Phase Circuits
1. Voltage Sources
2. Power Calculations

Introduction to the Laplace Transform
1. Functional Transforms
2. Operationsl Transforms

The Laplace Transform in Circuit Analysis
2. Partial Fraction Expansion
3. Convolution Integral

Introduction to Frequency Selective Circuits
1. Low & High Pass Filters
2. Bandpass Filters
3. Bode Diagrams

Active Filter Circuits
1. First Order
2. Higher Order

Fourier Series
1. Fourier Coefficients
2. Symmetry

The Fourier Transform

1. Derivation
2. Convergence
3. Limits

Two Port Circuits

1. Terminal Equations
2. Parameters

NOTE: Eastern Washington University strives to make academic accommodations for students with identified special needs. Students with disabilities are encouraged to make an appointment or see me during my listed office hours.

Winter 2003

ENGR 250 – DIGITAL CIRCUITS II

Department of Engineering Technology at Eastern Washington University

OBJECTIVE: Digital Design is concerned with the design of digital electronic circuits. Digital circuits are employed in the design of many systems such as computers, control systems, data communications, and many others. This course is the second in a two-quarter course sequence intended to teach the analysis and design of digital circuits. ENGR250 is a continuation of ENGR160. It is comprised of a series of both hardware and software exercises in support of the theoretical topics introduced in ENGR160.

COURSE OBJECTIVES: By the end of this class you should be able to:

- Design and optimize complex sequential logic circuits using both state diagrams and ASM charts.
- Derive synchronous and ripple counters.
- Design and use registers.
- Describe random access memory and read only memory.
- Describe memory decoding, and error detection and correction.
- Identify programmable array logic and programmably logic arrays.

INSTRUCTOR: First Last-Name
E-mail: First.Last-name@ewu.edu
Office: Cheney Hall XXX
Phone: (509) 359-YYYY

PREREQUISITES: ENGR 160 (Digital Circuits I)

OFFICE HOURS: Monday -- Thursday: 10:30 AM – 11:30 AM
I encourage you to make appointments if these times conflict with your schedule.

REFERENCE TEXT: *Digital Design*, Third Edition by M. Morris Mano. Prentice Hall, 2002.

LECTURES: Monday 1:00 PM – 2:00 PM. Cheney Hall 208.
Monday 2:00 PM – 4:00 PM. Science Hall 169.

WEB SITE: The website for this course is:
http://www.technology.ewu.edu/Engr250/
Please check it periodically, as all the assigned homework, together with the homework solutions, handouts, etc will be posted there. Note that the last slash is needed!

GRADING:

Assignments:	0%	Will not be collected.
Quizzes:	30%	No make up quizzes.
Labs/Reports:	40%	
Projects :	30%	

There will be **no** curve.

4.0↔100	3.5↔90	3.0↔80	2.0↔70	1.0↔60
4.0↔99	3.4↔89	2.9↔79	1.9↔69	0.9↔59
4.0↔98	3.4↔88	2.8↔78	1.8↔68	0.9↔58
4.0↔97	3.3↔87	2.7↔77	1.7↔67	0.8↔57
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3.9↔94	3.2↔84	2.4↔74	1.4↔64	0↔54-0

3.8↔93	3.1↔83	2.3↔73	1.3↔63	
3.7↔92	3.1↔82	2.2↔72	1.2↔62	
3.6↔91	3.0↔81	2.1↔71	1.1↔61	

QUIZZES: Quizzes will be held during the quarter based on the material in the assignments, lectures, and labs. There will be NO make-up quizzes.

HOMEWORK: Homework will be assigned periodically, but it will not be collected. Solutions will be made available one week after it was assigned. Note that quizzes will be based on the homework.

FINAL EXAM: There will be no final examination. However, there will be a quiz on the last day of class.

LABS: Labs are to be done during the last two hours of class. Each week you will receive a handout explaining exactly what you are to design and/or implement. The instructor MUST check your circuit before you leave lab. A lab report is due at the beginning of lecture the following week. The lab report should be typed. Circuit diagrams may be drawn by hand, however they must be neat. Late lab reports will NOT be accepted. Lab reports should follow the format indicated by the lab handout.

ACADEMIC DISHONESTY: **Violations of academic dishonesty will be sanctioned.** Violations of academic integrity involve the use of any method or technique enabling a student to misrepresent the quality and integrity of his or her own academic work or the work of a fellow student. Students committing academic dishonesty will be reported to the appropriate university official and an XF grade for this course will be recorded on the student's transcript. In cases where a student has an existing record of academic dishonesty, a more severe penalty, e.g. involving suspension or dismissal from the university, may be sought.

HOLIDAYS: Holiday Day: MTWRF, Month ZZ.

TENTATIVE OUTLINE: **Chapter 5: Synchronous Sequential Logic**

5.4 Analysis of Clocked Sequential Circuits
5.5 State /reduction and Assignment
5.6 Design Procedure

Chapter 6: Registers and Counters

6.1 Registers
6.2 Shift Registers
6.3 Ripple Counters
6.4 Synchronous Counters
6.5 Other Counters

Chapter 7: Memory

7.1 Introduction
7.2 Random-Access Memory
7.3 Memory Decoding
7.4 Error Detection and Correction
7.5 Read-Only Memory
7.6 Programmable Logic Array
7.7 Programmable Array Logic

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Spring 2003

ENGR260 – Microprocessors I

Department of Engineering Technology at Eastern Washington University

DESCRIPTION: Microprocessors I is a course to learn low level program language on the principles of a single-board microcomputer built around the Motorola 68HC11 microcontroller. The course emphasizes assembly language programming techniques and introduces input/output problems and the use of a microcomputer development system.

COURSE OBJECTIVES: By the end of this class you should be able to:

- Explain microprocessor, microcontroller, assembler, machine code, and source code.
- Identify all pseudo-operations and directives provided by assembler.
- Determine basic structure of hardware and all instruction sets in MC68HC11.
- Design basic programs related to stack, subroutine, and interrupts.
- Apply above knowledge to make assembly programs for various given problems.

INSTRUCTOR: First Last-Name
E-mail: First.Last-name@ewu.edu
Office: Cheney Hall XXX
Phone: (509) 359-YYYY

PREREQUISITES: ENGR 160 (Digital Circuits I)

OFFICE HOURS: Monday – Thursday : 09:00 AM – 10:00 AM
I encourage you to make appointments if these times conflict with your schedule.

REFERENCE TEXT: *"Microcontroller Technology: The 68HC11"* Fourth Edition by Peter Spasov
© 2002 by Prentice-Hall, Inc., ISBN 0-13-019579-0

LECTURES: Monday, Tuesday and Wednesday : 10:00 AM – 10:50 AM (Cheney Hall 205)

LABORATORIES: Friday : 1:00 AM – 2:50 PM (Labs, Science BLDG 169)

WEB SITE: The website for this course is:
http://www.technology.ewu.edu/Engr260/
Please check it periodically, as all the assigned homework, together with the homework solutions, handouts, etc. will be posted there. Note that the last slash is needed!

HOMEWORK: Homework will be assigned each Friday and will be due exactly one week after, at the beginning of class. Assignments are to be done neatly in pencil an/or computer, with all pages stapled together. Sloppiness will not be tolerated.

FINAL EXAM: Will be on Thursday, Mar. 20 (9:00 ~ 11:00 AM) It will be comprehensive. No make up on ANY circumstance.

GRADING:

Assignments:	25%	Due during class on the due date.
Lab Reports:	25%	Due at the beginning of the next lab period.
Midterm:	20%	No make up quizzes.
Final Exam:	30%	Comprehensive.

4.0↔100	3.5↔90	3.0↔80	2.0↔70	1.0↔60
4.0↔99	3.4↔89	2.9↔79	1.9↔69	0.9↔59
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4.0↔97	3.3↔87	2.7↔77	1.7↔67	0.8↔57

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3.6↔91	3.0↔81	2.1↔71	1.1↔61	

ACADEMIC DISHONESTY: **Violations of academic dishonesty will be sanctioned.** Violations of academic integrity involve the use of any method or technique enabling a student to misrepresent the quality and integrity of his or her own academic work or the work of a fellow student. Students committing academic dishonesty will be reported to the appropriate university official and an XF grade for this course will be recorded on the student's transcript. In cases where a student has an existing record of academic dishonesty, a more severe penalty, e.g. involving suspension or dismissal from the university, may be sought.

HOLIDAYS: Holiday Day: MTWRF, Month ZZ.

TENTATIVE OUTLINE:

Chapter 1: Introducing Microcontroller Technology
- 1.1 What Is a Microcontroller?
- 1.2 History
- 1.3 Top-Down View of Microcontroller Systems
- 1.4 Memory Concepts
- 1.5 Microcontroller Memory Map

Chapter 2: Software
- 2.1 Assembly and Other Programming Languages
- 2.2 Source Code, Object Code, and the Assembler
- 2.4 Fetch/Execute Operation of the Central Processing Unit (CPU)
- 2.5 The Instruction Set and Addressing Modes
- 2.8 Program Flow Control Using Looping and Branching
- 2.6 Basic Operations
- 2.7 Microcontroller Arithmetic and the Condition Code Register

Chapter 3: The Stack, Subroutines, Interrupts, and Resets
- 3.1 Introducing the Stack
- 3.2 Using the Stack to Store Data
- 3.3 Using Subroutines
- 3.4 Modular Programming Using Subroutines
- 3.5 Subroutine Operation
- 3.6 Concept of Interrupts
- 3.7 Interrupt Vectors
- 3.8 Interrupt Operation
- 3.9 Hardware Interrupts and Resets
- 3.10 Software and CPU Control Interrupts
- 3.11 The Kiss of Death: Stack Overflow

Chapter 4: Cross Assembly and Program Development
- 4.2 Format of the Source Code
- 4.3 Code and Data Segments
- 4.4 Pseudo-Operations
- 4.5 The Assembly Two-Pass Process
- 4.6 Assembler Options and Preprocessor Directives

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Spring 2003

ENGR320 – SIGNALS AND SYSTEMS I

Department of Engineering Technology at Eastern Washington University

DESCRIPTION: We live the information era. We are overwhelmed with information in our daily routine: TV, radio, cell phones, internet, etc. All information is transmitted by signals, which are just set of data. These data vary with respect to an independent variable: time. This class will give you an introduction to the mathematical and physical concepts required to understand the representation and modeling of signals. It will also present ways or processes to extract and modify information from a signal. Such processes are called systems. The special case of continuous time-invariant systems will be studied in detail.

COURSE OBJECTIVES: By the end of this class you should be able to:

- Identify a signal according to its discrete or continuous nature.
- Describe each of the following system categories: Linear, nonlinear, time-invariant, time-varying, causal, noncausal, memoryless, dynamic, continuous-time, discrete-time, lumped-parameter, distributed-parameter.
- Classify a system into any of the aforementioned categories.
- Evaluate the convolution operator either in continuous-time or discrete-time.
- Analyze a linear time-invariant system both in the time and frequency domains.
- Model a physical signal by using mathematical functions, and solve the equations when excited by an arbitrary function.
- Explain the relation between the time and frequency domains, and apply techniques for converting from one domain to another.

INSTRUCTOR: First Last-Name
E-mail: First.Last-name@ewu.edu
Office: Cheney Hall XXX
Phone: (509) 359-YYYY

PREREQUISITES: MATH 163 (Calculus III) and ENGR 210 (Circuits II)

OFFICE HOURS: Monday -- Friday: 10:30 AM – 11:30 AM
I encourage you to make appointments if these times conflict with your schedule.

REFERENCE TEXT: *Linear Systems and Signals* by B. P. Lathi. Oxford, 2002.

LECTURES: Monday, Tuesday, and Wednesday: 9:00 AM – 10:00 PM, Cheney Hall 107.

LABORATORIES: Thursday: 8:00 AM – 10:00 AM, Science Hall 171.

WEB SITE: The website for this course is:
http://www.technology.ewu.edu/Engr320/
Please check it periodically, as all the assigned homework, together with the homework solutions, handouts, etc. will be posted there. Note that the last slash is needed!

QUIZZES: Quizzes will be held weekly. There will be NO make-up quizzes, as I will drop the lowest quiz grade.

HOMEWORK: Working in groups is encouraged. Homework will be assigned each Monday and will be due exactly one week after, at the beginning of class. If Monday is a holiday, homework will be assigned Tuesday. Assignments are to be done neatly in pencil, with all pages stapled together. Sloppiness will not be tolerated.

FINAL EXAM: The Final Examination for this course will be comprehensive. No make up Final Exam will be given under ANY circumstances.

GRADING:

Assignments:	10%	Due during class on the due date.
Lab Reports:	30%	Due at the beginning of the next lab period.
Quizzes:	30%	No make up quizzes.
Final Exam:	30%	Comprehensive.

4.0↔100	3.5↔90	3.0↔80	2.0↔70	1.0↔60
4.0↔99	3.4↔89	2.9↔79	1.9↔69	0.9↔59
4.0↔98	3.4↔88	2.8↔78	1.8↔68	0.9↔58
4.0↔97	3.3↔87	2.7↔77	1.7↔67	0.8↔57
4.0↔96	3.3↔86	2.6↔76	1.6↔66	0.8↔56
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3.7↔92	3.1↔82	2.2↔72	1.2↔62	
3.6↔91	3.0↔81	2.1↔71	1.1↔61	

CHEATING: Cheating on a midterm or final examination will result in failing the course. No exceptions.

HOLIDAYS: Holiday Day: MTWRF, Month ZZ.

TENTATIVE OUTLINE:

I. **Introduction**
1. Complex numbers
2. Sinusoids
3. Partial fraction expansion
4. Vectors and matrices
5. Signals and systems
6. Classification of systems
7. Input-output description

II. Time-Domain Analysis of Continuous-Time Systems
1. System response to internal conditions: Zero-input response
2. Unit impulse function
3. System response to external input: Zero-state response
4. Numerical convolution
5. System stability
6. System behavior

III. Time-Domain Analysis of Continuous-Time Systems
1. Laplace transform
2. Analysis of electrical networks
3. Fourier series
4. Exponential Fourier series
5. Fourier transform
6. LTI system analysis by Fourier transform

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Spring 2003

ENGR321 – SIGNALS AND SYSTEMS II

Department of Engineering Technology at Eastern Washington University

DESCRIPTION:	We live the information era. We are overwhelmed with information in our daily routine: TV, radio, cell phones, internet, etc. All information is transmitted by signals, which are just set of data. These data vary with respect to an independent variable: time. This class will give you a continuation to the concepts introduced in ENGR 320.
COURSE OBJECTIVES:	By the end of this class you should be able to: • Identify the Laplace Transform, Z-transform, the Fourier Series, the Fourier Transform, the Discrete Fourier Transform (DFT), and the Discrete-Time Fourier Transform (DTFT). • Analyze Linear Time Invariant (LTI) system using above techniques for continuous and discrete time and explain the relationship between input and output using above techniques for continuous and discrete time. • Identify the Sampling Theorem.
INSTRUCTOR:	First Last-Name E-mail: First.Last-name@ewu.edu Office: Cheney Hall XXX Phone: (509) 359-YYYY
PREREQUISITES:	ENGR 320(Signals and Systems I)
OFFICE HOURS:	Monday -- Friday: 10:30 AM – 11:30 AM I encourage you to make appointments if these times conflict with your schedule.
REFERENCE TEXT:	*Linear Systems and Signals* by B. P. Lathi. Oxford, 2002.
LECTURES:	Monday, Tuesday, and Wednesday: 9:00 AM – 10:00 PM, Cheney Hall 107.
LABORATORIES:	Thursday: 8:00 AM – 10:00 AM, Science Hall 171.
WEB SITE:	The website for this course is: *http://www.technology.ewu.edu/Engr321/* Please check it periodically, as all the assigned homework, together with the homework solutions, handouts, etc. will be posted there. Note that the last slash is needed!
QUIZZES:	Quizzes will be held weekly. There will be NO make-up quizzes, as I will drop the lowest quiz grade.
HOMEWORK:	Homework will be assigned each Monday and will be due exactly one week after, at the beginning of class. If Monday is a holiday, homework will be assigned Tuesday. Assignments are to be done neatly in pencil, with all pages stapled together. Sloppiness will not be tolerated.
FINAL EXAM:	Final examination will be held Thursday, June 12, from 8:00 PM – 10:00 PM in Cheney Hall 107. It will be comprehensive. No make up on ANY circumstance.
GRADING:	Assignments: 10% Due during class on the due date. Lab Reports: 30% Due at the beginning of the next lab period. Quizzes: 30% No make up quizzes. Final Exam: 30% Comprehensive.

4.0↔100	3.5↔90	3.0↔80	2.0↔70	1.0↔60
4.0↔99	3.4↔89	2.9↔79	1.9↔69	0.9↔59
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4.0↔95	3.2↔85	2.5↔75	1.5↔65	0.7↔55
3.9↔94	3.2↔84	2.4↔74	1.4↔64	0↔54-0
3.8↔93	3.1↔83	2.3↔73	1.3↔63	
3.7↔92	3.1↔82	2.2↔72	1.2↔62	
3.6↔91	3.0↔81	2.1↔71	1.1↔61	

CHEATING: Cheating on a midterm or final examination will result in failing the course. No exceptions.

HOLIDAYS: Holiday Day: MTWRF, Month ZZ.

TENTATIVE OUTLINE:

I. Continuous-Time Systems : Laplace Transform Analysis
1. The Laplace Transform
2. Some Properties of the Laplace Transform
3. Transform Solution of Differential and Integral-Differential Equations.
4. Analysis of Electrical Networks: Transformed Network Method
5. Block Diagrams
6. System Realization
7. Frequency-Response of an LTIC system

II. Discrete-Time Systems: Z-transform Analysis
1. The Z-transform
2. Some properties of the Z-transform
3. Z-transform solution of Difference Equations
4. System Realization
5. Frequency Response of Discrete-Time Systems
6. Connection Between the Z-transform and Laplace Transform

III. Continuous-Time Signal Analysis: The Fourier Series
1. Representation of Periodic Signals by Trigonometric Fourier Series
2. Exponential Fourier Series
3. Alternate View of Fourier Representation : Signal –Vector Analysis

IV. Continuous-Time Signal Analysis: The Fourier Transform
1. Nonperiodic Signal Representation By Fourier Integral
2. Physical Appreciation of the Fourier Transform
3. Transform of Some Useful Fourier Transform
4. Some Properties of the Fourier Transform
5. LTI System Analysis by Fourier Transform

V. Sampling
1. The Sampling Theorem
2. The Discrete Fourier Transform (DFT)

VI. Analysis of Discrete-Time Signals

1. Discrete-Time Periodic Signals
2. Nonperiodic Signals: The Discrete-Time Fourier Transform (DTFT)
3. Properties of DTFT
4. LTID System Analysis by DTFT
5. Relationships among various Transforms.

NOTE: Eastern Washington University strives to make academic accommodations for students with identified special needs. Students with disabilities are encouraged to make an appointment or see me during my listed office hours.

Spring 2003

ENGR330 – ELECTRONICS I

Department of Engineering Technology at Eastern Washington University

DESCRIPTION: Electronic I is the first course in modeling, characterization, and application of semiconductor devices and integrated circuits. Development of appropriate models for circuit-level behavior of diodes, bi-polar and field effect transistors, and non-ideal op-amps. Application in analysis and design of linear amplifiers. Frequency domain characterization of transistor circuits.

COURSE OBJECTIVES: By the end of this class you should be able to:

- Discuss component level models of bipolar and field effect transistors.
- Ability to design differential and multi-stage transistor amplifier circuits.
- Knowledge of and design skills for non-ideal op-amp circuits.

Topics covered include:

- Op-Amp Nonidealities,
- Bipolar Junction Transistor,
- BJT Amplifier Configurations,
- Field Effect Transistor,
- FET Amplifiers,
- Integrated MOS Amplifiers, and
- Small Signal Operation.

INSTRUCTOR: First Last-Name
E-mail: First.Last-name@ewu.edu
Office: Cheney Hall XXX
Phone: (509) 359-YYYY

PREREQUISITES: MATH 163 (Calculus III) and ENGR 210 (Circuits II)

OFFICE HOURS: Monday -- Friday: 10:30 AM – 11:30 AM
I encourage you to make appointments if these times conflict with your schedule.

REFERENCE TEXT: ***Microelectronic Circuits*** by Adel S. Sadra & Kenneth C. Smith. Oxford, 1998.

LECTURES: Monday, Tuesday, and Wednesday: 11:00 AM – 12:00 Noon, Cheney Hall 107.

LABORATORIES: Thursday: 1:00 PM – 2:00 PM, Science Hall 171.

WEB SITE: The website for this course is:
http://www.technology.ewu.edu/Engr330/
Please check it periodically, as all the assigned homework, together with the homework solutions, handouts, etc. will be posted there. Note that the last slash is needed!

QUIZZES: Quizzes will be held weekly. There will be NO make-up quizzes, as I will drop the lowest quiz grade.

HOMEWORK: Working in groups is encouraged. Homework will be assigned each Monday and will be due exactly one week after, at the beginning of class. If Monday is a holiday, homework will be assigned Tuesday. Assignments are to be done neatly in pencil, with all pages stapled together. Sloppiness will not be tolerated.

FINAL EXAM: The Final Examination for this course will be comprehensive. No make up Final Exam will be given under ANY circumstances.

GRADING:

Assignments:	10%	Due during class on the due date.
Lab Reports:	30%	Due at the beginning of the next lab period.
Quizzes:	30%	No make up quizzes.
Final Exam:	30%	Comprehensive.

4.0↔100	3.5↔90	3.0↔80	2.0↔70	1.0↔60
4.0↔99	3.4↔89	2.9↔79	1.9↔69	0.9↔59
4.0↔98	3.4↔88	2.8↔78	1.8↔68	0.9↔58
4.0↔97	3.3↔87	2.7↔77	1.7↔67	0.8↔57
4.0↔96	3.3↔86	2.6↔76	1.6↔66	0.8↔56
4.0↔95	3.2↔85	2.5↔75	1.5↔65	0.7↔55
3.9↔94	3.2↔84	2.4↔74	1.4↔64	0↔54-0
3.8↔93	3.1↔83	2.3↔73	1.3↔63	
3.7↔92	3.1↔82	2.2↔72	1.2↔62	
3.6↔91	3.0↔81	2.1↔71	1.1↔61	

CHEATING: Cheating on a midterm or final examination will result in failing the course. No exceptions.

HOLIDAYS: Holiday Day: MTWRF, Month ZZ.

TENTATIVE OUTLINE:

I. Introduction to Electronics
1. Frequency Spectrum of Signals
2. Analog and Digital Signals
3. Circuit Models for Amplifiers
4. Frequency Response of Amplifiers
5. The Digital Logic Converter

II. Operational Amplifiers
1. The Ideal Op Amp
2. The Inverting Configuration
3. The Noninverting Configuration
4. Large Signal Operation of Op Amps
5. DC Imperfections

III. Diodes
1. The Ideal Diode
2. Physical Operation of Diodes
3. Analysis of Diode Circuits
4. Rectifier Circuits
5. Limiting and Clamping Circuits

IV. Bipolar Junction Transistors (BJTs)
1. Physical Structure and Modes of Operation
2. The npn Transistor
3. The pnp Transistor
4. Analysis of Transistor Circuits
5. Small Signal Equivalent Circuit Models

V. Field Effect Transistors
1. MOSFET Circuits
2. Biasing in MOS Amplifier Circuits
3. Basic Configurations of Single Stage IC MOS Amplifiers
4. The Junction Field Effect Transistor (JFET)
5. Gallium Arsenide (GaAs) Devices – The MESFET

NOTE: Eastern Washington University strives to make academic accommodations for students with identified special needs. Students with disabilities are encouraged to make an appointment or see me during my listed office hours.

Spring 2003

ENGR 331 – ELECTRONICS II

Department of Engineering Technology at Eastern Washington University

DESCRIPTION: Electronic Circuits II is the second course in the modeling and application of semiconductor devices and integrated circuits. Advanced transistor amplifier analysis, including feedback effects are studied. The design for power amplifiers, op-amps, analog filters, oscillators, A/D and D/A converters, and power converters are also covered. An introduction to transistor level design of CMOS digital circuits is also included.

COURSE OBJECTIVES: By the end of this class you should be able to:

- Evaluate the frequency response of amplifiers and construct Bode plots based upon the appropriate transistor models.
- Calculate midband gains and input and output impedances for single and multistage amplifiers.
- Determine the effect of feedback on an amplifier's stability, gain and input and output impedances.
- Apply general feedback theory to the design of operational amplifier circuits.
- Evaluate and control oscillatory frequencies for common sinusoidal oscillators.
- Design multiple-section low-pass, high-pass, and band-pass active filters, employing appropriate filter approximations and common circuit configurations.
- Apply circuits used to convert between digital and analog signals and utilize A/D and D/A converters in circuits.
- Optimize digital circuits containing dynamic logic circuits and semiconductor memories.
- Design signal generators and wave shaping circuits.
- Design electronic circuits suitable for implementation in monolithic IC fabrication.

INSTRUCTOR: First Last-Name
E-mail: First.Last-name@ewu.edu
Office: Cheney Hall XXX
Phone: (509) 359-YYYY

PREREQUISITES: MATH 163 (Calculus III) and ENGR 3300 (Electronics I)

OFFICE HOURS: Monday -- Friday: 10:30 AM – 11:30 AM
I encourage you to make appointments if these times conflict with your schedule.

REFERENCE TEXT: ***Microelectronic Circuits*** by Adel S. Sadra & Kenneth C. Smith. Oxford, 1998.

LECTURES: Monday, Tuesday, and Wednesday: 11:00 AM – 12:00 Noon, Cheney Hall 107.

LABORATORIES: Thursday: 1:00 PM – 2:00 PM, Science Hall 171.

WEB SITE: The website for this course is:
http://www.technology.ewu.edu/Engr331/
Please check it periodically, as all the assigned homework, together with the homework solutions, handouts, etc. will be posted there. Note that the last slash is needed!

QUIZZES: Quizzes will be held weekly. There will be NO make-up quizzes, as I will drop the lowest quiz grade.

HOMEWORK: Working in groups is encouraged. Homework will be assigned each Monday and will be due exactly one week after, at the beginning of class. If Monday is a holiday, homework will be assigned Tuesday. Assignments are to be done neatly in pencil, with all pages stapled together. Sloppiness will not be tolerated.

FINAL EXAM: The Final Examination for this course will be comprehensive. No make up Final Exam will be given under ANY circumstances.

GRADING:

Assignments:	10%	Due during class on the due date.
Lab Reports:	30%	Due at the beginning of the next lab period.
Quizzes:	30%	No make up quizzes.
Final Exam:	30%	Comprehensive.

4.0↔100	3.5↔90	3.0↔80	2.0↔70	1.0↔60
4.0↔99	3.4↔89	2.9↔79	1.9↔69	0.9↔59
4.0↔98	3.4↔88	2.8↔78	1.8↔68	0.9↔58
4.0↔97	3.3↔87	2.7↔77	1.7↔67	0.8↔57
4.0↔96	3.3↔86	2.6↔76	1.6↔66	0.8↔56
4.0↔95	3.2↔85	2.5↔75	1.5↔65	0.7↔55
3.9↔94	3.2↔84	2.4↔74	1.4↔64	0↔54-0
3.8↔93	3.1↔83	2.3↔73	1.3↔63	
3.7↔92	3.1↔82	2.2↔72	1.2↔62	
3.6↔91	3.0↔81	2.1↔71	1.1↔61	

CHEATING: Cheating on a midterm or final examination will result in failing the course. No exceptions.

HOLIDAYS: Holiday Day: MTWRF, Month ZZ.

TENTATIVE OUTLINE:

I. Differential and Multistage Amplifiers
1. Small Signal operation
2. Nonideal characteristics
3. Multistage Amplifiers

II. Frequency Response
1. S-Domain Analysis
2. Low Frequency Response
3. High Frequency Response

III. Feedback
1. Four Basic Feedback Topologies
2. Determining Loop Gain
3. The Stability Problem

IV. Output Stages and Power Amplifiers
1. Classification of Output Stages
2. Class A Output Stage
3. Class B Output Stage

IV. Analog Integrated Circuits
1. Op-Amp Circuit
2. Signal Analysis
3. Data Converters

V. Filters and Tuned Amplifiers
1. Butterworth and Chebyshev Filters
2. Sensitivity
3. Tuned Amplifiers

VI. Signal Generators and Wave Shaping Circuits
1. Sinusoidal Oscillators
2. Bistable Multivibrators
3. Integrated Circuit Timers

VII. Digital Circuits

1. Dynamic Logic Circuits
2. Pseudo NMOS Logic Circuits
3. Semiconductor Memories

VIII. BiPolar and Advanced Technology Digital Circuits

1. Dynamic Operation
2. Emitter Coupled Logic (ECL)
3. Gallium Arsenide Circuits

NOTE: Eastern Washington University strives to make academic accommodations for students with identified special needs. Students with disabilities are encouraged to make an appointment or see me during my listed office hours.

Spring 2003

ENGR350 – ENERGY SYSTEMS

Department of Engineering Technology and Multimedia Design at Eastern Washington University

DESCRIPTION: This course provides an introduction to the different energy sources, methods of electric energy conversion, the electric power system and its components, transformers, and electrical machines.

COURSE OBJECTIVES: By the end of this class the student will be able to:

- Perform calculations for generation, transmission, distribution and conversion of electric energy.
- Apply methods of analyzing magnetic circuits and transformers.
- Design and analyze synchronous (AC) and direct current (DC) machines.

INSTRUCTOR:
First Last-Name
E-mail: First.Last-name@ewu.edu
Office: Cheney Hall XXX
Phone: (509) 359-YYYY

PREREQUISITES: ENGR 210 (Circuits II) and PHYS 401 (Electromagnetism I)

OFFICE HOURS: Monday -- Friday: 9:00-10:00 AM daily.
I encourage you to make appointments if these times conflict with your schedule.

REFERENCE TEXT: *Electromechanical Energy Devices and Power Systems* by Z.A. Yamayee and J.L. Bala. Wiley, 1994

LECTURES: Monday and Thursday 8:00 AM – 9:45 AM, Cheney Hall 107.

LABORATORIES: Wednesday: 8:00 AM – 9:45 AM, Science Hall 171.

WEB SITE: The website for this course is:
http://www.technology.ewu.edu/Engr350/
Please check it periodically, as all the assigned homework, together with the homework solutions, handouts, etc. will be posted there. Note that the last slash is needed!

QUIZZES: Quizzes will be held weekly. There will be NO make-up quizzes, as I will drop the lowest quiz grade.

HOMEWORK: Working in groups is encouraged. Homework will be assigned each Monday and will be due exactly one week after, at the beginning of class. If Monday is a holiday, homework will be assigned Tuesday. Assignments are to be done neatly in pencil, with all pages stapled together. Sloppiness will not be tolerated.

FINAL EXAM: Final examination will be held Thursday, June 12, from 8:00 PM – 10:00 PM in Cheney Hall 107. It will be comprehensive. No make up on ANY circumstance.

GRADING:

Assignments:	10%	Due during class on the due date.
Lab Reports:	30%	Due at the beginning of the next lab period.
Quizzes:	30%	No make up quizzes.
Final Exam:	30%	Comprehensive.

4.0↔100	3.5↔90	3.0↔80	2.0↔70	1.0↔60
4.0↔99	3.4↔89	2.9↔79	1.9↔69	0.9↔59

4.0↔98	3.4↔88	2.8↔78	1.8↔68	0.9↔58
4.0↔97	3.3↔87	2.7↔77	1.7↔67	0.8↔57
4.0↔96	3.3↔86	2.6↔76	1.6↔66	0.8↔56
4.0↔95	3.2↔85	2.5↔75	1.5↔65	0.7↔55
3.9↔94	3.2↔84	2.4↔74	1.4↔64	0↔54-0
3.8↔93	3.1↔83	2.3↔73	1.3↔63	
3.7↔92	3.1↔82	2.2↔72	1.2↔62	
3.6↔91	3.0↔81	2.1↔71	1.1↔61	

ACADEMIC DISHONESTY: **Violations of academic dishonesty will be sanctioned.** Violations of academic integrity involve the use of any method or technique enabling a student to misrepresent the quality and integrity of his or her own academic work or the work of a fellow student. Students committing academic dishonesty will be reported to the appropriate university official and an XF grade for this course will be recorded on the student's transcript. In cases where a student has an existing record of academic dishonesty, a more severe penalty, e.g. involving suspension or dismissal from the university, may be sought.

HOLIDAYS: Holiday Day: MTWRF, Month ZZ.

TENTATIVE OUTLINE:

I. Energy Resources and Electric Energy Conversion

1. Introduction
2. Energy Resources
3. Conventional Methods for Electric Energy Conversion
4. Alternative Methods for Electric Energy Conversion

II. Power System Components and Analysis

1. Introduction
2. Power System Structure
3. Power System Analysis Problems
4. The Computer Connection
5. The Role of the Power Engineer

III. Magnetic Circuits and Transformers

1. Introduction
2. Magnetic Circuits
3. Faraday's Law
4. Inductance and Magnetic Energy
5. Transformers
6. Autotransformer
7. Three-Phase Transformers

IV. Fundamentals of Rotating Machines

1. Introduction
2. Basic Concepts of Energy Converters
3. Rotating Machines
4. Armature MMF and Magnetic Field
5. Rotating MMF in AC Machines
6. Generated Voltage in Rotating Machines
7. Torque in Round-Rotor Machines

V. DC Machines

1. Introduction
2. Basic Principles of Operation
3. Generation of Unidirectional Voltage

4. Types of DC Machines
5. DC Machine Analysis
6. DC Generator Performance
7. DC Motor Performance

VI. Synchronous Machines

1. Introduction
2. Round-Rotor Synchronous Machines
3. Salient-Pole Synchronous Machines
4. Generator Synchronization

NOTE: Eastern Washington University strives to make academic accommodations for students with identified special needs. Students with disabilities are encouraged to make an appointment or see me during my listed office hours.

Spring 2003

ENGR490 – SENIOR CAPSTONE: DESIGN LABORATORY

Department of Engineering Technology at Eastern Washington University

DESCRIPTION: This course will simulate the industrial environment, where students will have to work in a cross-disciplinary team to solve a real world problem, from design to implementation. Team dynamics will be strictly monitored and each student's unique skills will be utilized in different stages of the design process. Dealing with problems typical of a team environment will result in an invaluable learning experience both in the professional and civic lives of the students.

COURSE OBJECTIVES: By the end of this class you should be able to:

- Work in a team environment of cross disciplinary nature.
- Analyze, evaluate, segment, and solve a problem based on engineering specifications.
- Implement a problem solution by integrating the unique skills of each member in a team.
- Verify and report inconsistencies in design specifications.
- Present a report in a professional manner.

INSTRUCTOR: First Last-Name
E-mail: First.Last-name@ewu.edu
Office: Cheney Hall XXX
Phone: (509) 359-YYYY

PREREQUISITES: Senior standing, ENGR 331 or TECH 408.

OFFICE HOURS: Monday -- Friday: 10:30 AM – 11:30 AM
I encourage you to make appointments if these times conflict with your schedule.

REFERENCE TEXT: *Fundamentals of Engineering Design* by Barry Hyman, 2/e. Prentice Hall, 2003.

LECTURES: Monday and Wednesday: 1:00 PM – 2:00 PM, Cheney Hall 208.

LABORATORIES: Monday and Wednesday: 2:00 PM – 4:00 PM, Science Hall 169.

WEB SITE: The website for this course is:
http://www.technology.ewu.edu/Engr490/
Note that the last slash is needed!

FINAL PRESENTATION: Final presentations will be held the week before finals during scheduled class time.

GRADING:

Final Product:	15%
Reports:	40%
Exams:	20%
Oral Presentation	5%
Peer Evaluation:	15%
Class Participation:	5%

.

4.0↔100	3.5↔90	3.0↔80	2.0↔70	1.0↔60
4.0↔99	3.4↔89	2.9↔79	1.9↔69	0.9↔59
4.0↔98	3.4↔88	2.8↔78	1.8↔68	0.9↔58
4.0↔97	3.3↔87	2.7↔77	1.7↔67	0.8↔57

4.0↔96	3.3↔86	2.6↔76	1.6↔66	0.8↔56
4.0↔95	3.2↔85	2.5↔75	1.5↔65	0.7↔55
3.9↔94	3.2↔84	2.4↔74	1.4↔64	0↔54-0
3.8↔93	3.1↔83	2.3↔73	1.3↔63	
3.7↔92	3.1↔82	2.2↔72	1.2↔62	
3.6↔91	3.0↔81	2.1↔71	1.1↔61	

ACADEMIC DISHONESTY: **Violations of academic dishonesty will be sanctioned.** Violations of academic integrity involve the use of any method or technique enabling a student to misrepresent the quality and integrity of his or her own academic work or the work of a fellow student. Students committing academic dishonesty will be reported to the appropriate university official and an XF grade for this course will be recorded on the student's transcript. In cases where a student has an existing record of academic dishonesty, a more severe penalty, e.g. involving suspension or dismissal from the university, may be sought.

HOLIDAYS: Holiday Day: MTWRF, Month ZZ.

TENTATIVE OUTLINE:

1. Introduction to Engineering Design.
2. Problem Formulation.
3. Information and Communication.
4. Professional and Social Context of Design.
5. Probabilistic Considerations in Design.
6. Concept Generation.
7. Project Planning.
8. Engineering Economics.
9. Decision Making.
10. Optimum Design.

NOTE: Eastern Washington University strives to make academic accommodations for students with identified special needs. Students with disabilities are encouraged to make an appointment or see me during my listed office hours.

Appendix II: Proposed Program for a Bachelor of Science in Electrical Engineering Seattle Community Colleges Transfer 4 year Program

Seattle Community Colleges Transfer Guide

Electrical Engineering at EWU
Tentative 4-yr plan

	Fall		Winter		Spring		By subject	
	Freshman						Engl	10
	MATH 124 Calc. I	5	*MATH 125 Calc. II*	5	*MATH 126 Calc. III*	5	Prog Prin	5
	VLPA	5	*VLPA*	5	*VLPA*	5	Math	15
	English 101	5	*English 102*	5	*CSC 142 Computer Progr.*	5	VPLA	15
45	Total	15	Total	15	Total	15		
	Sophomore						Engl	3
	I & S	5	*I&S*	5	*I&S*	5	Chem	5
	CHEM 140 General Chem.	5	*ECR 231 Techn. Writing 3 cr.*	3	*MATH 220 Linear Alg*	4	Math	10
	PHYS 201 Engr. Physics I	5	*PHYS 202 Engr. Physics II*	5	*PHYS 203 Engr. Physics III*	5	Phys	15
	Math 224 Vector Calculus	3	*MATH 238 Differential Eq*	3	Digital Circuits I (ENGR160)	4	I&S	15
52	Total	18	Total	16	Total	18	Engr	4
	Junior							
	CSC143 Comp. Prog. II	5	Signals and Systems I (ENGR 320)	5	Signals and Systems II (ENGR 321)	5	Prog. Prin.	5
	ECR 215 Fund. of Elect. Engr	5	Electronics II (ENGR 331)	5	Microprocessors I (ENGR 260)	5	Engr	37
	Electronics I (ENGR 330)	5	Circuits II (ENGR 210)	5	Approved Elective	5	Appr. El	5
			Digital Circuits II (ENGR250)	2				
47	Total	15	Total	17	Total	15		
	Senior							
	Prob. and Intro. to Statistics (MATH 385) (4 cr)		EE Elective	5	EE Elective	5	Engr	9
	or Elem. Prob. and Statistics (MATH 380)	5	Energy Systems (ENGR 350)	5	Tech. and World Civil. (TECH 393)	4	Capstone	4
	EE Elective	5	*Cultural/Gender Div.*	4	Capstone (ENGR 490)	4	Cult Div	4
	Electromagnetism (PHYS 401)	4					EE Elec	15
41	Total	14	Total	14	Total	13	Tech393	4
185							Math	5

Italics indicates courses taken at Seattle CC

Mathematics	30	Sciences	20	Programming Proficiency	10
Core Courses	50	EE Electives	15	VPLA/I&S	30
Written and Oral Communications	13	Cult. Div.	4	Tech 393, International Studies Req.	4
Approved Electives	5	Capstone	4		
		TOTAL 185			

Appendix III: Proposed Program for a Bachelor of Science in Electrical Engineering
Spokane Falls Community College Transfer 4 year Program

Electrical Engineering at EWU
Tentative 4-yr plan

	Fall		Winter		Spring		By subject	
	Freshman						ENGR	3
	Calc. and Analytic Geometry I (MATH 124)	5	*Calc. and Anal. Geom. I (MATH 125)*	5	*Calc. and Analytic Geom. I (MATH 126)*	5	Math	15
	Advanced General Chemistry CHEM 141	5	*Humanities/Social Science*	5	*Humanities/Social Science*	5	Hu/Soc Sci	20
	Technical Writing (ENG 205)	5	*Humanities/Social Science*	5	*Humanities/Social Science*	5	H/PE/Re/LA	5
	Engr. Prob. and Orientation (ENGR110)	3	*Health Related/PE/Recr../Leisure Act.*	2	*Health Related/PE/Recr./Leisure Act.*	3	Engl	5
53	Total	18	Total	17	Total	18	Chem.	5
	Sophomore							
	Engineering Physics I PHYS 201)	5	*Humanities/Social Science*	5	*Engineering Physics III PHYS 203)*	5	ENGR	5
	Humanities/Social Science	5	*Engineering Physics II PHYS 202)*	5	Electric Circuit Theory (ENGR 210)	5	Math	15
	Linear Algebra (MATH 220)	5	*Multivariable Calculus (MATH 224)*	5	*Elementary Diff. Equations (MATH 274)*	5	Phys	15
45	Total	15	Total	15	Total	15	Hum/Soc.	10
	Junior							
	Digital Circuits I (ENGR 160)	4	Signals and Systems I (ENGR 320)	5	Programming Principles II (CSCD 226)	5	Prog. Prin.	11
	Electronics I (ENGR 330)	5	Electronics II (ENGR 331)	5	Signals and Systems II (ENGR 321)	5	Engr	35
	Programming Principles I (CSCD 225)	5	Circuits II (ENGR 210)	5	Microprocessors I (ENGR 260)	4		
	Programming Principles I Lab (CSCD 205)	1	Digital Circuits II (ENGR250)	2				
46	Total	15	Total	17	Total	14		
	Senior							
	Prob. and Intro. to Statistics (MATH 385) (4 cr)		EE Elective	5	EE Elective	5	Engr	9
	or Elem. Prob. and Statistics (MATH 380)	5	Energy Systems (ENGR 350)	5	Technology and World Civil. (TECH 393)	4	Capstone	4
	EE Elective	5	Cultural/Gender Diversity GECR	4	Capstone (ENGR 490)	4	Cult Div	4
	Electromagnetism (PHYS 401)	4					EE Elec	10
41	Total	14	Total	14	Total	13	Tech393	4
185							Math	5

Italics indicates courses taken at SFCC

Mathematics	35	Sciences	20	Programming Proficiency	11
Core Courses	49	EE Electives	15	Humanities/Social Sciences	30
Written and Oral Communications	5	Cult. Div.	4	Tech 393. International Studies Req.	4
Capstone	4	Health Rel./PE/Recreat./Leisure Act.	5	ENGR	3
		TOTAL 185			

Appendix IV: EWU Electrical Engineering Laboratory Equipment

Digital and Circuit labs

Item	Equipment Information	Quantity
Workbench	N/A	15
Digital Oscilloscope	Philips PM3335/PM3337	12
Logic Analyzer	Philips PM3580/PM3585	2
Spectrum Analizer	HP 3585A	3
Digital Multimeter	Various types	15
Pulse Generators	Philips PM 5786	1
Power Supply	Various types	19
Programmable timer/counter	Philips PM6666 120 Mhz	9
Function Generators	Various types	11
Programmable synthesizer / function generator	Fluke PM5193	1
Video analyzer	SENCORE Model VA48	1
Memory / PAL programmer	Various types	3
Transistor-curve tracer	Tektronix 575	1
CPU tester	8080A and 6800 tester	2
Microcontroller design kit	Intel Microsystem/Microcontroller design kit	21
Microprocessor boards	MC68HC11 board	11
Programmable logic device	Digilet FPGA board	11
Xilinx ISE 5.2i (10 station licenses)	Xilinx	1
Multisim 2001 (25 station licenses)	Electronics Workbench	1
Matlab (15 station licenses)	The Mathworks	1
Computer	Various types	9

Robotics / Control lab

Item	Equipment Information	Quantity
Workbench	N/A	16
Robot	INTELLEDEX Model 1400	4
Robot	GMF Robotics A-1	1
Robot	GMF Robotics M-1	1
Robot	GMF Robotics S-108	1
Air compressor	Central Pneumatic air compressor 2HP - 8 gallon	1
Small robot	PARALLAX robotics	15
Programmable logic controller (PLC)	Allen-Bradley Micro Logix 1200	7
Computer	various types	22

Power lab

Item	Equipment Information	Quantity
0.2-kW Electromechanical Training System	LabVolt 8001	2
0.2-kW Protective Relaying Training System	LabVolt 8007	2
2-kW Electromechanical Training System	LabVolt 8013	2
AC Variable Speed Drive	LabVolt 3260	5
Computer-Assisted 0.2-kW Electromechanical Training System	LabVolt 8006	2

DC Variable Speed Drive	LabVolt 3250	5
Motor Winding Kit	LabVolt 8022	5
Power Electronics Training System	LabVolt 8032	2
Synchro-Servo Training System	LabVolt 8060	2
Dissectible Machines	LabVolt 8020	3
FET fundamentals (Training Kit)	LabVolt 91010	5
Power Supply Regulation Circuits (Training Kit)	LabVolt 91009	5
Power Transistors and GTO Thyristors (Training Kit)	LabVolt 91026	5
Thyristors and Power Control Circuits (Training Kit)	LabVolt 91011	5
Transistor Amplifier Circuits (Training Kit)	LabVolt 91006	5
Transistor Feedback Circuits (Training Kit)	LabVolt 91008	5
Transistor Power Amplifiers (Training Kit)	LabVolt 91007	5
Distribution Transformer Trainer	LabVolt 8361	5
Vector-Control Drive Converter	LabVolt 9013	5
Data Acquisition Interface	LabVolt 9062	5
Digital Multimeter	HP-34401A	5
DC Power Supply	HP-E3461A	5
Oscilloscope	HP-54621A	5
Function Generator	HP-33120A	5
Miscellaneous (devices, probes etc)		1
PC		5

Network lab

Item	Equipment Information	Quantity
Dual 10/100 Ethernet Router with 2 WIC Slots & 1 NM Slot	CISCO2621XM	6
Cisco 2600 Series IOS ENTERPRISE PLUS IPSEC 56	S26AK8-12212	3
32 to 64MB DRAM factory upgrade	MEM2600XM-32U64D	3
2-Port Serial WAN Interface Card	WIC-2T	3
1-Port Channelized T1/ISDN-PRI Network Module	NM-1CT1	1
Mid Performance 10/100 Ethernet Router with Cisco IOS IP	CISCO2620XM	12
2-Port Async/Sync Serial WAN Interface Card	WIC-2A/S	7
1-Port ISDN with NT-1 WAN Interface Card	WIC-1B-U	4
V.35 Cable, DTE Male to Smart Serial, 10 Feet	CAB-SS-V35MT	12
V.35 Cable, DCE Female to Smart Serial, 10 Feet	CAB-SS-V35FC	12
RS-232 Cable, DTE to Smart Serial, 10 Feet	CAB-SS-232MT	2
SMARTnet 8x5xNBD for Cisco26XX	CON-SNT-26xx	9
CCNP Bundle	ATLAS550-CCNP	1
Catalyst 3550, 24-10/100 and 2 GBIC ports:Enhanced Multilayer SW Image	WS-C3550-24-EMI	6
24 10/100 ports w/ 2 10/100/1000BASE-T ports, Enhanced Image	WS-C2950T-24	12
1000BASE-T GBIC	WS-G5483	6
SMARTnet 8x5xNBD Svc, WS-C3550-24E	CON-SNT-C3550-24E	3
8x5xNBD Svc, C2950 24 10/100 ports 2 10/100/100BASE-T	CON-SNT-C2950T24	6
802.11b AP w/Avail Cbus Slot, FCC Cnfg	AIR-AP1220B-A-K9	2
1200 Platform 110-220V Power Supply and Injector System	AIR-PSINJSYS1200	2
2.4 GHz, 2.2 dBi Dipole Antenna w/RP-TNC Connector	AIR-ANT4941	4
8x5xNBD Svc, AIR-AP 1220B-A-K9	CON-SNT-AIRAP1220	2
PK	AIR-PC1352/10	1
Catalyst 3524-PWR-XL Enterprise Edition	WS-C3550-24-PWR-SMI	1
SMI Software Image	CON-SNT-C3550-24-PW	1

PIX 501 3DES Bundle (Chassis, SW, 10 users, 3DES)	PIX-501-BUN-K9	2
Bundle (Chassis: SW: 10User: DES)	CON-SNT-PIX501-10	2
32 MB DRAM DIMM for the Cisco 2600 Series	MEM2600-32D	3
Cisco 2600 Series IOS ENTERPRISE PLUS IPSEC 56	S26AK8-12212	3

PC Labs

ITEM	Equipment Information	Quantity
PCs	Various types	65
Scanner	Various types	10
Printer	Various types	4

Appendix V: North Seattle Community College Laboratory Equipment

Digital and Circuit labs

Item	Equipment Information	Quantity
Workstations (2 students per station)		40
Oscilloscopes	TEK 2205 (20 MHz - Dual Channel)	20
Digital Oscilloscopes	TEK TDS 2012	20
Logic Analyzers	Philips Model PM 3580	2
Computers	E-4000 Gateway Computers	40
Circuit Simulation Software	Multisim	40
Digital Multimeters	Fluke 8000A	20
Digital Multimeters	Fluke 8050A	20
Pulse Generators		0
Power Supply	TEK CPS 250 Triple Power Supply	20
Power Supply	BK Precision 1650 Triple Power Supply	20
Function Generators	BK Precision Model 3010	40
Frequency Counters	Fluke 7220A	15
Frequency Counters	Kenwood FC-757	10
Programmable logic devices	Altera CPLD board	20
LAB VOLT EQUIPMENT - FACET SYSTEM		
FACET Computer Interface Base Unit	Model 91000-20 (No built in power supply)	5
Laboratory Instrument	Model 1242 (Power Supply, Multimeter & Function Gen.)	5
Semiconductor Devices Module	Model 91005	5
Transistor Amplifier Circuits Module	Model 91006	5
Transistor Power Amplifiers Module	Model 91007	5
Transistor Feedback Circuits Module	Model 91008	5
Power Supply Regulation Circuits Module	Model 91009	5
FET Fundamentals Module	Model 91010	2
Thyristor and Power Control Circuits Module	Model 91011	5
Operational Amplifier Fundamentals Module	Model 91012	5
Operational Amplifier Applications Module	Model 91013	5
Digital Logic Fundamentals Module	Model 91014	5
Digital Circuit Fundamentals 1 Module	Model 91015	5
Digital Circuit Fundamentals 2 Module	Model 91016	2
32-Bit Microprocessor Circuit Board Module	Model 91017	1
Analog Communications Circuit Board Module	Model 91018	1
Transducer Fundamentals Module	Model 91019	1

Digital Communciatoions 1 Circuit Board Module	Model 91022	1
Digital Communciatoions 2 Circuit Board Module	Model 91023	1
Fiber Optic Communications Circuit Board Module	Model 91025	2
Digital Signal Processor Circuit Board Module	Model 91027	2

Note: Maxmimum 60 students can use Digital labs.

Power lab

Item	**Equipment Information**	**Quantity**
Power System Simulator	Flexlab-The Standard Electric Time Co.	1
Motor/Generator Units	5 HP DC Compound Motor or Generator	4
	magnetically coupled to a	
	5 HP Wound Rotor Induction/Synchronous	
	Motor or Generator	
Series 100 Fractional Horsepower Motor &	Hampden Model HMD-100-CM Console	5
Generator Learning System	complete with AC-DC power supplies,	
Hampden Engeering Corporation	AC instrumentation, DC instrumentation,	
	single-phase and three-phase wattmeter	
	panel.	
	DM-100A DC Machines	5
	SM-100 -3 Synchronous Machines	5
	CSM-100 Capacitor Start Motors	4
	SPM-100 Split Phase Motor	4
	IM-100 Induction Motor	5
	WRM-100-3A Wound Rotor Motor	5
	MFM-100 Multi-Function Machine	5
	PB-100 Prony Brake	1
	DYN-100-DM Dynamometer	5
	RL-100A Resistance Load Bank-DC	5
	RLC-100 Resistance/Reactance Load	5
	WRSC-100 Wound Rotor Speed Control	4
	SFR-100 Series Field Rheostat	4
	Strobe and Friction Tachnometers	10
	T-100A 1Phase Experimental Transformers	15
Rotating electric machines	Hampden Model H-REM-1ACM-MP	1
	Universal Laboratory Machine	

Note: Maxmimum 24 students can use Power labs.

Networking lab

Item	Quantity
Four Networking Lab Rooms with 28 Computer Stations per Room	112
with necessary switches, routers and test equipment.	
These classrooms are presently used to teach Network Administration, SQL Server,	
Exchange Server, Network Security Fundamentals, Network Defense and	
Computer Forensics	
Two CISCO Labs and one CISCO classroom.	
CCNA Lab Stations	24
CCNP Lab Stations	18
Labs include computers, routers, switches, PIX firewalls, Fluke one touch network	
analyzer and DS 4000 cable tester.	

Note: Maxmimum 80 students can use Networking labs.

Appendix VI: Resumes

Dr. Min-Sung Koh
Professor William Loendorf (Pre-engineering)
Professor Esteban Rodriguez-Marek (Pre-engineering)
Dr. Michael A. Brzoska Department Chair

MIN-SUNG KOH

Phone : (509) 359-4342

Email min-sung.koh@mail.ewu.edu

EDUCATION:

1/97 ~ 05/02 : Washington State University, Pullman, Washington, USA
- Ph. D. in Electrical and Computer Engineering
  Dissertation : " Speech Enhancement Using a Truncated and Constrained Minimum Variance Estimator in Non-Uniform Wavelet Filterbanks"

3/94 ~ 2/96 : Ulsan university, Ulsan, South Korea
- M.S. in the department of Control and Instrumentation
  Thesis : "A study on inverted pendulum control using PID, FUZZY and H^{∞} theories".

3/91 ~ 2/94 : Ulsan university, Ulsan, South Korea
- B.E. in the department of Control and Instrumentation

3/86 ~ 2/88 : Ulsan Junior College, Ulsan, South Korea
- Diploma for Nuclear Engineer in the department of Nuclear Engineering.

EXPERIENCE:

9/02 ~ present : Assistant Professor in Eastern Washington University

1/98 ~ 5/02 : Research Assistant in Washington State University
- Worked on speech enhancement to eliminate the noise in corrupted speech.
- Worked on signal enhancement for photoacoustic signal and fetal sound.

3/94 ~ 2/96 : Research Assistant in Ulsan university
- Development of ECU (Electronic Control Unit) for HYUNDAI auto company.
- Research on the classic control algorithms and Fuzzy controller.

10/89 ~ 12/96 : Nuclear Engineer in KEPCO (Korea Electric Power Co.).
- At KORI #3 NPP (Nuclear Power Plant), my responsibility were Reactor operation, Turbine operation, Electrical equipment Operation and the test to prove safety, analysis of abnormal condition, and making each operation procedures.

2/88 ~ 10/89 : Nuclear engineer in KEPCO (Korea Electric Power Co.).
- At ULJIN NPP (Nuclear Power Plant), my work was supervising non-nuclear engineer, responsible for mechanical equipment installation, testing and analysis of NCR (Non-Conformation Report) with ALSTHOM in France.

COMPUTER SKILLS:

C, ASSEMBLER(8086/8088, 80196), OrCAD, VHDL, UNIX, LINUX, Windows, DOS, MATLAB

AWARDS AND SCHOLARSHIP:

- The "First Place Prize" in the "Student Paper Competition" at the Asilomar Conference on Signals, Systems and Computers on Nov. 5, 2001
- Award for an outstanding graduate from ULSAN university 1994.

- Scholarship for outstanding undergraduate student from ULSAN University : 1991 ~ 1994
- Scholarship from Korea Electric Power Co. : 1983 ~ 1988

INVITED TALKS:

1. M. S. Koh and M. Mortz, "Signal enhancement and curve fitting for photoacoustic waveforms", Interdisciplinary mini-symposium on data analysis and hardware for photacoustics, Feb. , 2001, (Eastern Washington University)
2. M. Mortz and M. S. Koh, "Model-free deconvolution with downsampling", Interdisciplinary mini-symposium on data analysis and hardware for photacoustics, Feb. , 2001, (Eastern Washington University)
3. M. S. Koh and M. Mortz, " Denoising speech by the combination of cochlear filterbanks and advanced signal processing", The National Center for Rehabilitative Auditory Research, Oregon, Jul. 27, 2001

PUBLICATIONS:

1. M. S. Koh, M. Mortz and N. Vaughan, "Performance results of noisy speech enhancement using undecimated wavelets and spectral peak enhancement", J. Acous. Soc. Of Am., vol. 107, no. 5, Pt. 2, pp. 2828, Atlanta, GA. May. 2000
2. M. S. Koh and M. Mortz, "Improved voice activity detection of noisy speech", J. Acous. Soc. Of Am., vol. 107, no. 5, Pt. 2, pp. 2907~2908, Atlanta, GA. May. 2000
3. M. S. Koh and M. Mortz, "Speech enhancement through perceptual wavelets with truncated singular value decomposition (TSVD)", IEEE Int. Symposium On Intelligent Sig. Proc. and Comm. Sys. , vol. 1, pp. 304~309, Nov. 2000
4. M. S. Koh and M. Mortz, "Speech enhancement based on truncated and constrained minimum variance estimator and undecimated wavelet packet non-uniform filterbanks", the 35th Asilomar Conference on Signal, System and Computers, pp. 538~544, Nov. 2001 (This paper is selected as the "First Place Winner" in the "Student Paper Competition" on Nov. 5, 2001)
5. T. Preston, B. McCracken, M. Hebner, H. Lightfoot, D. Lightfoot, M. Mortz, M. S. Koh and J. R. Small, "Pulsed-laser photoacoustics studies of vegetative bacteria and bacterial endospores", Biophysical Journal, vol. 82, no.1, pp. 42a, Feb., 2002.
6. L. Libertini, A. Horton, T. Preston, B. McCracken, H. Lightfoot, M. Mortz, M. S. Koh and J. R. Small, "Toward single-particle photoacoustics", Biophysical Journal, vol. 82, no.1, pp. 42a, Feb., 2002.
7. M. S. Koh and M. Mortz, "Speech enhancement based on truncated and constrained minimum variance estimator (TCMVE) in the approximated critical filter banks", submitted to IEEE Trans. on Speech and Audio Proc., Jan. 2002
8. E. Rodriguez-Marek, M. Brzoska, M. S. Koh, W. Loendorf, and A. Inoue, "Developing a Software Engineering Technology Program", will be shown in the Proc. of the 2003 ASEE annual Conf. and Exposition, session 2558, June 22 ~ 25, Nashville, TN, 2003

WILLIAM R. LOENDORF

Phone: (509) 359-7396
Email: william.loendorf@mail.ewu.edu

EDUCATION

MBA with Honors, Lake Forest Graduate School of Management, Lake Forest, IL - 1997
Major: Business Management

MS in Electrical Engineering, Colorado State University, Fort Collins, CO - 1973
Thesis: "Implementation of Digital Controllers"

BS in Engineering Science, University of Wisconsin - Parkside, Kenosha, WI - 1971
Major: Electrical Engineering and Computer Science

INSTRUCTIONAL EXPERIENCE

Eastern Washington University, Cheney, Washington **2002 - Present**
Assistant Professor of Engineering Technology and Multimedia Design
Instructor and Facilitator of Computer Engineering Technology courses including: Technology in Western Civilization, Digital Circuits, and Circuit Analysis. Conducts student advising. Instrumental in directing and implementing a new Software Engineering Technology major that begins Fall Quarter 2003.

College of Lake County, Grayslake, Illinois **1997 - 2002**
Adjunct Associate Professor
Part-time Instructor and Facilitator of Computer Information Systems courses including: Introduction to Computers, Introduction to Programming with QBasic, Programming Concepts Using Visual Basic, Introduction to Visual Basic, and Managing Microcomputer Systems.

Regis University, Denver, Colorado **1985 - 1989**
Adjunct Associate Professor
Instructed and Facilitated Computer Science courses part-time that included: Introduction to Computer Science, Computer Science I, Computer Science II, Data Structures, Database Management, Structured Design, Basic Programming, and Advanced Programming.

University of Wisconsin - Parkside, Kenosha, Wisconsin **1974 - 1983**
Adjunct Associate Professor
Instructed and Facilitated Electrical Engineering and Computer Science courses part-time that included: Electrical Engineering Fundamentals, Circuit Theory, Digital Electronics, Digital Logic, Introduction to Computing, Fortran Programming, Computer Science I, Computer Science II, and Micro-Computer Applications.

PROFESSIONAL EXPERIENCE

MOTOROLA, INC., Northbrook, Illinois **1997 - December 2001**
Software Engineering Manager, Automotive and Industrial Electronics Group (AIEG) (1999 - 2001)

Responsible for the design, development and implementation of real-time embedded software for control sub systems utilized as front ends in automotive applications. Managed the staffing, planning, organizing, and controlling of software engineering development projects for Fortune 50 companies.

- Completed 15 software releases on time, exceeding customer expectations while 10% under budget.
- Created and maintained schedules for project planning and tracking to ensure lull featured, functional, on-time software releases while trading-off technical hardware/software solutions.
- Devised and developed an improved memory usage algorithm that allowed increased functionality in limited space, resulting in implementation of additional safety features.
- Managed projects with seven program management teams and four customers, implementing and delivering over 125 required features on schedule to increase revenues by 17%.
- Led two teams of six Motorola engineers and one team of five subcontractors, trained five engineers in SEI CMM Level 3 software development processes, accomplishing preset objectives.

Technical Accounts Sales Manager, Semiconductor Products Sector (SPS) (1997 - 1999)

Responsible for business development, introduction and sales of next generation products for Motorola MicroControllers, DSPs and other semiconductor devices to meet future customer requirements.

- Managed the technical design, development and review sessions for next generation semiconductor devices resulting in new leading-edge products along with increased sales and market penetration.
- Presented and promoted new state of the art MicroControllers/DSPs and their capabilities to over 100 engineers/managers to win new business, generating internal sales over $25 million.
- Coordinated resources of SPS and MEG Custom Integrated Circuit Design Group to produce custom Integrated Circuit's, resulting in over $10 million of incremental sales.
- Analyzed, directed, and implemented the marketing and sales of Motorola semiconductor devices to exceed the first year's sales target by 130% and the second year's target by 121%.

PRINTRONIX, INC., Glen Ellyn, Illinois **1992 - 1997**
Regional Systems Engineering Manager

Responsible for Field Engineering functions providing technical, sales, and marketing support to distributors, original equipment manufacturers (OEMs), value added resellers (VARs), and end users. Created, conducted and managed technical seminars, marketing presentations and training sessions.

- Organized and managed both internal and external project teams of four to six professionals to introduce new products, promote products and resolve problems, ensuring customer satisfaction.
- Developed new OEM accounts including IBM, Hewlett Packard, UNISYS and Wallace; influenced the direction for improved performance and functionality, resulting in 23% increase in sales volume.
- Conducted four successful next generation new product launches, promoting their state of the art real-time embedded controllers, increasing sales by over 17% and creating revenue leaders.

SUN MICROSYSTEMS, INC., Schaumburg, Illinois **1989 - 1991**
Application Marketing Representative / Senior Systems Engineer

Responsible for the technical and business aspects of regional sales campaigns, including the strategy, competitive agenda, and marshalling of the necessary internal and external resources to ensure success. Assessed needs and opportunities, organized technical and competitive data into operational programs.

- Managed business development for specific technical markets: Electronic Design Automation (EDA), Mechanical Computer Aided Design (MCAD), Computer Integrated Manufacturing (CIM), and Architecture/Engineering/Construction (AEC) creating over $15 million of leveraged business.
- Planned, organized, and conducted sales and marketing presentations, seminars, and workshops for presales activities that led to new business opportunities, increasing segment sales by over 20%.

Additional Professional Experience Includes:
CADNETIX, INC., Boulder, CO, **Staff Engineer,** Senior Applications Engineer **1984 - 1989**
GETTYS, INC., Racine, WI, **Senior Project Engineer** **1982 - 1983**
GM - Delco Electronics, Oak Creek, WI, **Special Projects Engineer** **1978 - 1982**

UNICO, INC., Franksville, WI, **Software Development Manager,** Project Engineer **1973 – 1978**

PROFESSIONAL DEVELOPMENT

Professional Engineer (PE) - Registered in Colorado, Illinois and Wisconsin
Member of the Institute of Electrical and Electronic Engineers (IEEE)
Member of the American Society of Engineering Educators (ASEE)

TECHNICAL PUBLICATIONS

- Rodriguez-Marek, E., Brzoska, M. A., Loendorf, W. R., Koh, M., Inoue, A., 2003: “Developing a Software Engineering Technology Program,” Proceedings of the American Society of Engineering Educators (ASEE) Conference, Nashville, Tennessee, June 22-25, 2003.
- Loendorf, W.R., 1991: “SUN Microsystems Midwest Area Reseller Reference Guide,” SUN Microsystems, Incorporated, 1991.
- Loendorf, W.R., 1991: “Strategic Advantages For The 90s - Client / Server Computing,” SUN Microsystems, Incorporated and Information Decisions, Incorporated, 1991.
- Loendorf, W.R., Brubaker, T.A., Smith, G., and Snowden, J., 1979: “Analysis of Interpolation Methods for Meteorological Satellite Images,” Proceedings of the IEEE Region V Conference, El Paso, Texas, April 3-5, 1979.
- Loendorf, W.R., and Perdikaris, G.A., 1978: “Software Architecture of a Real-Time Process Control Computer,” Proceedings of the Mid-West Electronics Conference (MIDCON), Dallas, Texas, December 12-14, 1978.
- Loendorf, W.R., and Perdikaris, G.A., and Beck, T.L., 1978: “A Microprocessor Based System for DC Servo Control,” Proceedings of the Western Electronics Conference (WESCON), Los Angeles, California, September 12 - 14, 1978.
- Loendorf, W.R., 1975: “Introduction to the Unico Real-Time System,” Unico, Incorporated, 1975.
- Loendorf, W.R., and Brubaker, T.A., 1973: “Implementation of Digital Controllers,” COMPUTERS AND ELECTRICAL ENGINEERING, Vol. 1, PP. 401 - 413, Peragamon Press, December, 1973.

Esteban Rodriguez-Marek, M. Sc.

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EDUCATION

M.S., Electrical Engineering, Washington State University, Pullman, August 1999. Thesis Title: *"Multiple Description Based Robust Video Coding Over Packet Erasure Networks."* Advisor: Thomas R. Fischer.

B.S., *Magna Cum Laude*, GPA Major: 3.93/4.00, GPA Overall: 3.82/4.00, Electrical Engineering, Washington State University, Pullman, August 1997.

PROFESSIONAL EXPERIENCE

Eastern Washington University, *Assistant Professor*, September 2001 – present.
Department of Engineering Technology and Multimedia Design.
In charge of developing curriculum and teaching in topics including circuit analysis, microprocessors, digital circuits, digital hardware, communication electronics, computer architecture, and other related fields. Current head of Computer Engineering Technology (CET) program. Currently in charge of developing a Software Engineering Technology (SET) program and an Electrical Engineering program.

FAST Search & Transfer, Inc., *Research Scientist*, July 1999 – September 2001.
Design and implement image and video compression systems. The systems were designed to broadcast on demand and live video to wireline and wireless systems for different devices and operating systems at various rates and qualities to adapt for different channel capacities. It used proprietary technology, although it also supported standard compression systems such as MPEG-4. All implementation was done in C and later ported into Java and native code, such as MIPS, ARM, EPOC.

JPEG-2000 Standardization Committee, August 1999 – March 2001.
Voting member of the JPEG-2000 committee in charge of determining the newly accepted standard for image compression. Participated in several conferences and meetings geared towards shaping the algorithm and documenting it.

Washington State University, *Graduate Research Assistant*, August 1997 – August 1999. Department of Electrical Engineering and Computer Science.
Designed and implemented algorithms for robust image and video compression. The systems were designed to stand packet losses on internet-like channels or packet erasure networks. The concealment algorithm was based on multiple description coding and POCS. The baseline video codec was H.26e. Developed a standalone DCT based video with performance equivalent to that of MPEG-2. Implementation was done in C/C++.

Washington State University, *Undergraduate Research Assistant*, May 1996-August 1997. Department of Electrical Engineering and Computer Science.
Investigated several algorithms for robust video compression. Improved already existing video compression software using wavelets and subband coding. Implementation was done in C.

Washington State University, *Undergraduate Research Assistant*, May 1995-August 1995. Department of Electrical Engineering and Computer Science.
Wrote a C package that performed subband decomposition image compression. The purpose was to investigate the performance of several different wavelet filters existing in the literature. Designed new filters for image decomposition and compared them to existing filters. Developed an image format conversions manual used by graduate students and professors at WSU. Developed DSP theory for filter design.
Designed and RSA-like encryption algorithm. Implemented it in VHDL and later tested the prototype built by Mosis Technology.

RELEVANT COURSEWORK

Graduate Level: Digital Communication systems, Signal Theory, Information Theory and Channel Coding, Data Compression, Advanced Electromagnetics, Random Processes and Stochastic systems, Linear Systems.

Undergraduate Level: Digital Signal Processing, Analog Communication systems, Digital Image Processing, Digital Communication systems, Digital system Design, VLSI Design, Control systems, Microprocessors, Advanced Digital Circuits, Analog Circuits.

HONORS

Sophomore of the Year of the Electrical Engineering and Computer Science Department (1994-1995).
Outstanding Freshman Certificate from the Washington State Mortar Board (1993-1994).
President's Honor Roll (1993-1997).
Kaiser Aluminum and Chemical Corporation Scholarship (1995-1997).

RELEVANT SKILLS

Windows operating systems, Linux, Unix, C, C++, HTTP, Matlab, Mathematica, assembly language (x86), image processing and video compression, DSP, familiar with standardization processes, fluent both in English and Spanish, experience in research environments and in team projects, Cisco certified network associate (CCNA), extensive knowledge in JPEG-2000, MPEG-x, H.26x.

PUBLICATIONS

Esteban Rodriguez-Marek and Thomas R. Fischer, "Video Coding Over Packet-Erasure Channels," in *Proc. Int. Conf. Image Proc.*, Chicago, IL, 1998.

Esteban Rodriguez-Marek and Thomas R. Fischer, "A Multiple Description Image Coder for Packet Erasure Channels," in Proc. *Nordic Signal Proc. Symp.*, Sweden, 2000.

Esteban Rodriguez-Marek, Mick Brzoska, Min-Sung Koh, William Loendorf and Atsushi Inoue, "Developing a Software Engineering Technology Program," in *Proc. Annual ASEE Conf.*, Nahville, TN, 2003.

Min-Sung Koh and Esteban Rodriguez-Marek, "Generalized and Parallelized A Trous and Mallat Algorithms to Design Non-Uniform Filter-Banks," to be presented at the *IEEE International Symposium on Signal Processing and Information Technology (ISSPIT)*, Darmstadt, Germany, December 2003.

GRANTS RECEIVED

National Science Foundation (NSF Id: 0230590): "Software Engineering Technology Program Development," ($100,000).
EWU Foundation Minigrant: "Purchase of an LCR Meter," October 2003, ($2,255).

MICHAEL A. BRZOSKA

Phone: (509) 359-7026
Email: Michael.brzoska@mail.ewu.edu

EDUCATION

Washington State University, Pullman, PhD Degree (1996) in Mechanical Engineering.
Washington State University, Pullman, M.S. Degree (1973) in Mechanical Engineering.
Washington State University, Pullman, B.S. Degree (1968) in Mechanical Engineering.

ACADEMIC POSITIONS

September 1983 to present:

Professor(1991), Department of Engineering Technology and Multimedia Design, Eastern Washington University. Teaching a variety of Technology and Engineering courses including Engineering Statics, Design, Fluid Mechanics, Graphics, Dynamics, Engineering Materials, Industrial Safety, Heat Transfer, and Strength of Materials.

Department Chair, 1985-1989, 1999- present

Director, Logging Safety Program, $100,000/yr. funding, Department of Labor, 1992-2001

Director, Comprehensive Mine Safety and Health, State Grants Program, $140,000/yr. funding, Department of Labor, 1990-present

August 1982 to August 1983:

Fulbright Professor, University of Liberia, Monrovia, Liberia. Taught Statics, Dynamics, Thermodynamics, and Fluid Mechanics. Gave technical assistance on the development of a Mechanical Engineering curriculum.

August 1981 to August 1982:

Visiting Assistant Professor, Department of Mechanical Engineering at the University of Idaho, Moscow, Idaho. Taught the following classes: Strength of Materials, Mechanical Vibrations, Machine Design, Junior and Senior Laboratories, and Graphics. Prepared a laboratory manual for the Junior Laboratory.

September 1979 to August 1981:

Visiting Instructor, Department of Mechanical Engineering at Washington State University. Taught the following classes: Thermodynamics, Heat Transfer, Strength of Materials Laboratory, and Senior Year Laboratory. Prepared a paper on the restructuring of the Senior Year Laboratory.

September 1973 to May 1977:

Assistant Professor, Cogswell College (four year college of Engineering Technology), San Francisco, California. Taught a wide variety of Engineering Technology classes including: Fluid Mechanics, Machine Design, Statics, Graphics, Descriptive Geometry, Materials and Processes, Mechanical Vibrations, Metallurgy, and others. Department Chair which included curriculum development, acquiring grants, and budgeting. Acquired a $40,000 SME grant for laboratory equipment.

Spring 1973:

Student teacher at Highline Community College, Seattle, Washington. Taught Surveying and Statics.

July 1968 to July 1970:
Instructor of Engineering at Central Luzon Polytechnic College, Cabanatuan City, Philippines while serving with the U.S. Peace Corps. Taught engineering, physics and math courses. Designed and supervised the installation of irrigation systems during summers.

INDUSTRIAL EXPERIENCE

May 1977 to September 1979, Summers 1984, 1985, & 1988:
Engineer for the Department of Transportation. Initially designed miscellaneous highway components including mechanical devices, irrigation and drainage systems, etc. Utilized computer aided design techniques. In 1979 was given complete responsibility for construction of a 15 mile section of SR 24 roadway. Supervised 10 to 20 engineers and engineering technicians. Responsible for irrigation and drainage installation, surveying, materials testing, earthwork, rock crushing, paving and design modification.

January 1971 to September 1972:
Employed by Peter Kiewit Sons' Co., Mechanical Division. Did field engineering which included job planning, scheduling and inspection. Also designed water systems and miscellaneous mechanical devices.

PUBLICATIONS/PRESENTATIONS:

Esteban Rodriguez-Marek, Mick Brzoska, Min-Sung Koh, William Loendorf and Atsushi Inoue, 2003: “Developing a Software Engineering Technology Program,” 2003 Annual Conference of the American Society for Engineering Education in Nashville, Tennessee, June 22-25.

Brzoska, M. A., Stock, D., and Lamb, B.: 2002: Experience with Using Computational Fluid Dynamics for Prediction of Pollution Dispersion about Buildings,” PNWIS 42nd Annual Conference, Tacoma, Washington, November 5-8, 2002.

Brzoska, M. A., Stock, D., Lamb, B, and Peterson, H. G., 2000: "Dispersion about a Building in a Stable Atmosphere," 2000 Computational Wind Engineering Conference, Birmingham, England, September 4-7, 2000.

Brzoska, M. A., Stock, D., Smith, R. M., Hickmott, S., Rabbitt, M., and Romero, E., 2000: "Simulation of Flow from a Negatively Buoyant Jet," 2000 ASME Fluids Engineering Division Summer Meeting, FEDSM00-11227, Boston, June 11-15, 2000.

Brzoska, M. A., Stock, D., and Lamb, B., 1999: "Comparison of First-Order Turbulence Model Predictions of Flow over Two-Dimensional Steps and a Rectangular Block," 1999 ASME Fluids Engineering Division Summer Meeting, FEDSM99-6968, San Francisco, July 18-23, 1999.

Brzoska, M. A., Stock, D., and Lamb, B., 1998: "Visualization, Description, and Comparison of Computed Flow About Buildings," 1998 ASME Fluids Engineering Division Summer Meeting, FEDSM98-4935, Washington, D. C., June 21-25, 1998.

Brzoska, M. A., Stock, D., and Lamb, B., 1998: "A Call for Front-Facing Step Benchmark Data," 1998 ASME Fluids Engineering Division Summer Meeting, FEDSM98-5099, Vancouver, Canada, June 21-25, 1998.

Brzoska, M. A., Stock, D., and Lamb, B., 1997: "Determination of Building Wake Capture," *Journal of Wind Engineering and Industrial Aerodynamics*, Vol. 67-68, 1997, pp 909-922.

Brzoska, M. A., Stock, D., and Lamb, B., 1997: "Computation of flow over Askervein," 1997 ASME Fluids Engineering Division Summer Meeting, FEDSM97-3703, Vancouver, Canada, June 22-26, 1997.

Brzoska, M. A., Stock, D., and Lamb, B., 1997: "Comparative study of flow about steps and buildings," 1997 ASME Fluids Engineering Division Summer Meeting, FEDSM97-3284, Vancouver, Canada, June 22-26, 1997.

Brzoska, M. A., Stock, D., and Lamb, B., 1996: "Grid Convergence Considerations for Three-Dimensional Finite Element Computations," Fifth Conference of the CFD Society of Canada, Victoria, Canada, May 27-29, 1997.

Brzoska, M. A., Stock, D., and Lamb, B., 1996: "Determination of Building Wake Capture," Proceedings of the Second International Symposium on Computational Wind Engineering, CWE '96, Fort Collins, CO, August 4-8, 1996.

Brzoska, M. A., Stock, D., and Lamb, B., 1996: "Three Dimensional Finite Elements Numerical Simulations of Airflow and Dispersion Around Buildings," American Meteorological Society Proceedings, Atlanta, GA, January 28-February 2, 1996.

Brzoska, M. A., Stock, D., and Lamb, B., 1995: "Computation of Flow and Dispersion about Buildings," American Society of Mechanical Engineers International Mechanical Engineering Congress and Exposition, San Francisco, CA, November 12-17, 1995.

Brzoska, M. A., 1990: "Upgrading Mechanical Engineering Technology Laboratories," American Society for Engineering Education International Conference Proceedings, Toronto, June, 1990.

Brzoska, M. A., 1986, 1990, 1997: *Materials Testing and Experimental Methods for Technologists, Laboratory Notes*, Cheney, Washington, Eastern Washington University.

Brzoska, M. A. and Barnes, W., 1983: *Experimental Methods for Engineers, Laboratory Notes*, Moscow, Idaho: University of Idaho.

Stock, D. and Brzoska, M. A., 1979: Integrating Communication Skills into the Senior Laboratory.," American Society for Engineering Education, 87th Conference, Louisiana State University, June 25-28, 1979.

PROFESSIONAL REGISTRATION

Professional Engineer--Mechanical Engineering, Washington State No. 232-01 0020634.

GRANTS RECEIVED

National Science Foundation $100,000, 2002/2003
DEPT of LABOR, $140,000, 2002/2003
DEPT of LABOR, $140,000, 2001/2002
OSHA, $60,000, 2000/2001
DEPT of LABOR, $130,000, 2000/2001
DEPT OF LABOR, $37,000, 2000/2001
THATS, $5,300, 2000/2001
OSHA, $81,000, 1999/2000

DEPT. of LABOR, $104,000, 1999/2000
OSHA, $108,000, 1998/1999
DEPT. of LABOR, $102,000, 1998/1999
OSHA, $76,500, 1997/1998
DEPT. of LABOR, $102,000, 1997/1998
OSHA, $76,500, 1996/1997
DEPT. of LABOR, $102,000, 1996/1997
DEPT. of LABOR, $106,000, 1995/1996
OSHA, $125,000, 1994/1996
DEPT. of LABOR, $94,000, 1994/1995
OSHA, $90,000, 1993/1995
DEPT. of LABOR, $125,000, 1993/1994
OSHA, $104,000, 1992/1993
DEPT. of LABOR, $130,000, 1992/1993
DEPT. of LABOR, $122,000, 1991/1992
SIRTI, $27,000, 1991
National Science Foundation, $50,000, 1990
EWU, $3,800, 1989
Society of Manufacturing Engineers, $8,000, 1989
THE BOEING CO., $5,000, 1989
KEY TRONIC, $4,000, 1989
FLUKE, $12,000, 1988
National Science Foundation, $ 8,000, 1987
Society of Manufacturing Engineers, $5,000, 1987
INTEL, $15,000, 1985

CONSULTING

Washington State University, numerical computations, 1999/2000
Haakon Industries, Inc., connector analysis and testing, 1996
Pyrotek Co., composite material analysis,1991
Avian Co., tank design, 1989
Symbiotics Co., analysis of brake device, 1989
Square D Corp., analysis of connectors, 1987
ISC, analysis of computer housing, 1986

OTHER PRESENTATIONS

"National Science Foundation Proposal Writing," MME/WSU Seminar, Pullman, May, 1993.
"Upgrading Mechanical Engineering Technology Laboratories," American Society for Engineering Education International Conference, Toronto, June, 1990.
"Proposal Writing," SBIR Workshop, Spokane, June, 1990.
"Invention Introductions," Innovation Workshop, Spokane, November, 1990.
"Engineering Fundamentals Review," SME Certification Presentation, December, 1990.